PEACE/WILLISTON
FISH & WILDLIFE
COMPENSATION
PROGRAM

BC hydro

BRITISH
COLUMBIA

Water Temperatures of the Nation and Mesilinka River Systems 1993

A. R. Langston
November 1993

PWFWCP Report No. 75

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The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave. 3rd Floor, Prince George B.C. V2L 3H9

Website: *www.bchydro.bc.ca/environment/initiatives/pwcp/*

This report has been approved by the Peace/Williston Fish and Wildlife Compensation Program Fish Technical Committee.

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TABLE OF CONTENTS

Table of contents ii

Introduction 1

Study area 1

Methods and materials 5

Results 5

- Blackpine (Mesilinka River mainstem) water temperatures 6
- Carina Creek (Mesilinka tributary) water temperatures 12
- Control Creek (Mesilinka tributary) water temperatures 18
- Culvert Creek (Mesilinka tributary) 24
- Gopherhole Creek (Mesilinka tributary) 30
- "Gratton's" (Mesilinka River mainstem) water temperatures 36
- Nation River mainstem water temperatures 42

References 46

INTRODUCTION

During the 1991 summer field season rivers within the Williston Reservoir watershed were investigated to identify a suitable system for a pilot stream fertilization project. Studies of chemical, physical, and biological characteristics of Williston watershed rivers (Barrett and Halsey 1985, Bruce and Starr 1985, Langston and Blackman 1993) were reviewed and suitable systems selected for preliminary analysis.

The Mesilinka River was selected as the most suitable system for the pilot project of nutrient enrichment. The Nation River was identified as a system which would also benefit greatly from a fertilization program, but would not meet as many of the pilot project objectives as the Mesilinka River (ie. The Mesilinka River is considered to be more representative of the rivers found in the Williston watershed). Results, and methodologies of the 1991 preliminary studies are reported in "Stream fertilization feasibility study 1991 data report" (Langston 1992).

In 1992 a five year pilot project was initiated on the Mesilinka River to assess the success of a fertilization program on a northern B.C. interior river system. This data report summarizes the water temperature data collected from the Mesilinka and Nation Rivers during the 1993 summer field season. This data is one component of the essential information required to facilitate the proper experimental design of the nutrient enrichment program.

Water temperature data reports (Langston 1992,1993) have been produced for these river systems as part of the Fertilization project in 1991, and 1992.

STUDY AREA

The Williston watershed is located in north central British Columbia with its southern boundary 40 km. north of Prince George. The watershed area is 70,860 km^2. The study area and Rivers examined are depicted in figures 1, 2, and 3. A more detailed description of the study area is available in the "Williston Lake Fisheries Compensation Program management plan" (Blackman et al 1990).

figure 1

MESILINKA RIVER

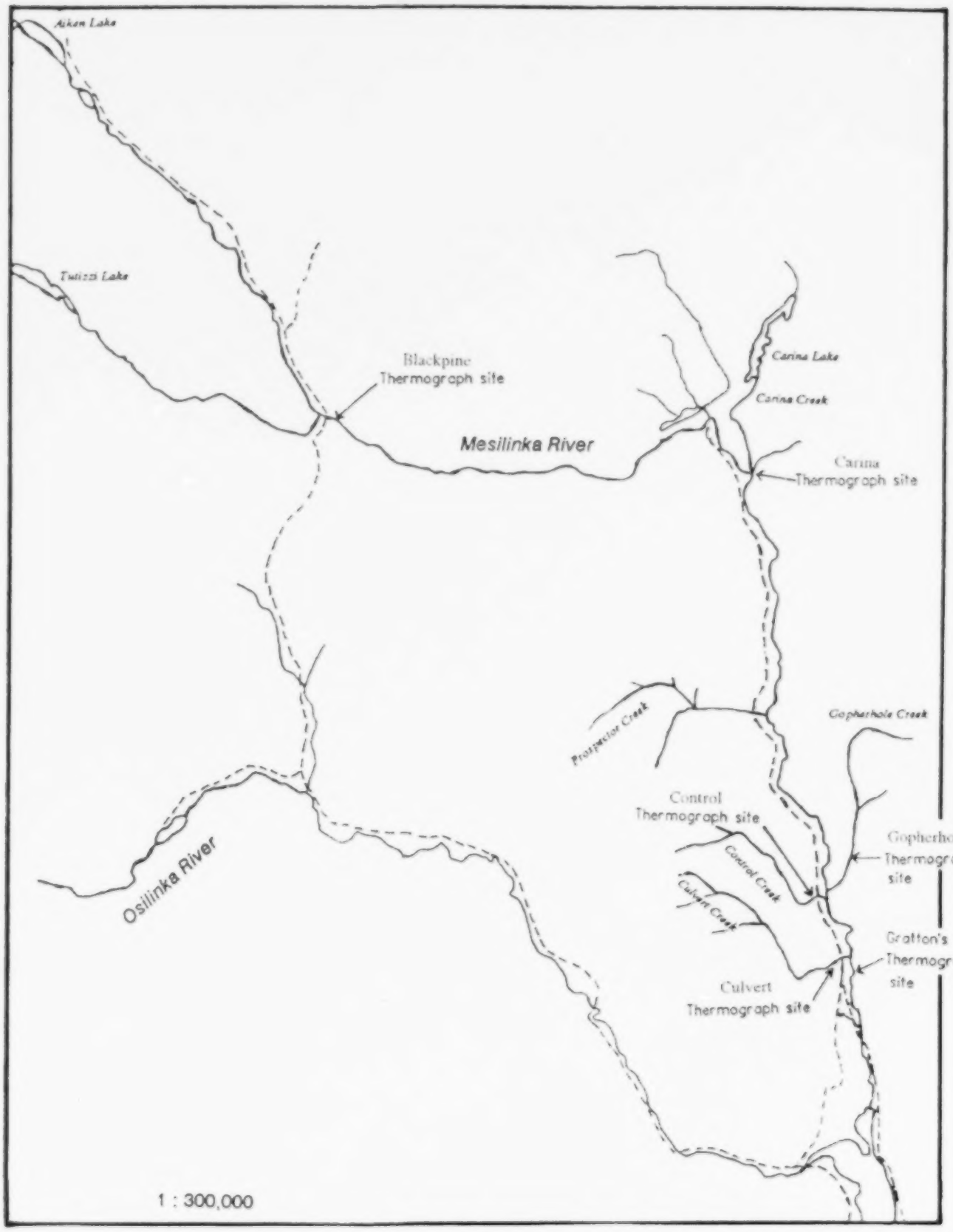


figure 2

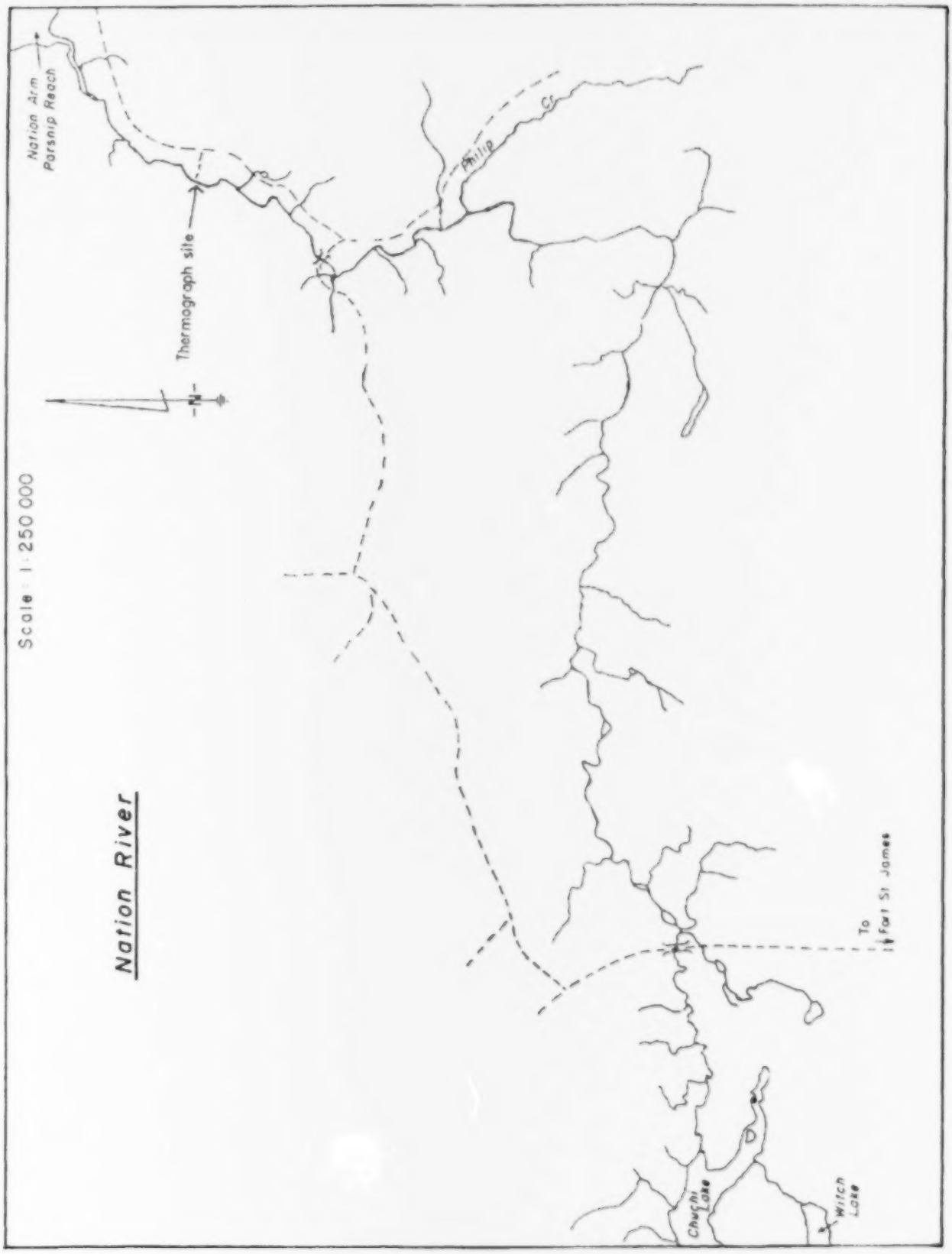

Nation River
Nation Arm
Parsnip Reach
Thermograph site
Phillip Cr.
N
Scale 1:250 000
To
Fort St James
Church Lake
Witch Lake

figure 3

METHODS AND MATERIALS

Water temperatures were monitored at preselected locations (see figure 2 for Mesilinka River system sites) with digital recording thermometers (Ryan Instruments TempMentors). These units are certified to be accurate to $\pm$ 0.3° C. Nation River water temperatures were monitored at the Water Survey of Canada site (figure 3). The TempMentors were set to record water temperatures at two hour sampling intervals. The sites were checked occasionally to ensure the TempMentor units were completely submerged and operating properly.

RESULTS

No formal discussion of the results is presented as this data report is intended primarily as an information source only. Water temperatures data results are presented in table and graph format. Mean temperatures, by month, and sampling period duration, are summarized and presented in table 1.

THERMOGRAPH RECORDED MEAN TEMPERATURES

LOCATION	RECORDING PERIOD	JUNE	JULY	AUGUST	SEPTEMBER	DURATION
"Blackpine"	June 14 - September 7	9.2	11.2	11.9	10.7	11
Carina Ck.	June 16 - September 14	12	13.6	14.4	12.6	13.5
Control Ck.	June 13 - September 7	5.8	7.4	8.2	7.7	7.4
Culvert Ck.	June 13 - September 7	6.5	8.2	9	8.4	8.1
Gopherhole Ck.	June 15 - September 7	6.7	8.3	9.1	8.4	8.3
"Gratton"	June 17 - September 7	9.6	11.5	12.1	11.3	11.4
Nation R.	June 30 - August 31 *	-	14.4	15.4	-	14.9

table 1

The following sites are repeat thermograph sites, and various years of data may be compared;

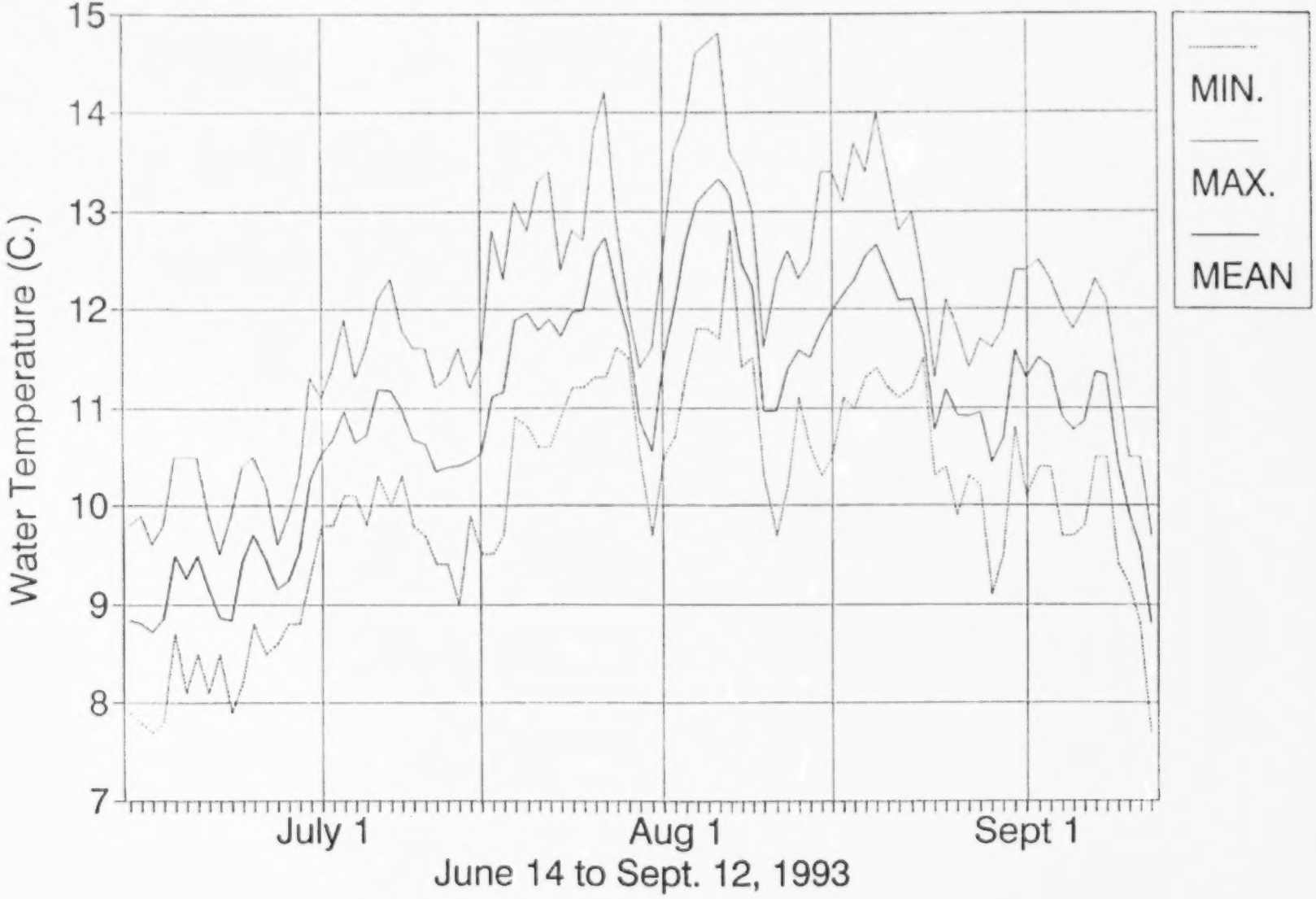
1)"Blackpine" (1993)...was "Control" (1992)...was "Upper Mesilinka" (1991)

2)"Gratton's" site was monitered both in 1992, and 1993 with a thermograph, and in 1991 with a minimum/maximum thermometer.

BLACKPINE WATER TEMPERATURES 1993

DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.
				July 1	10.5	11.1	9.8	Aug1	12.0	13.6	10.7	Sept 1	11.3	12.4	10.1
				July 2	10.7	11.4	9.8	Aug 2	12.7	13.9	11.3	Sept 2	11.5	12.5	10.4
				July 3	11.0	11.9	10.1	Aug 3	13.1	14.6	11.8	Sept 3	11.4	12.3	10.4
				July 4	10.6	11.3	10.1	Aug 4	13.2	14.7	11.8	Sept 4	10.9	12	9.7
				July 5	10.7	11.6	9.8	Aug 5	13.3	14.8	11.7	Sept 5	10.8	11.8	9.7
				July 6	11.2	12.1	10.3	Aug6	13.2	13.6	12.8	Sept 6	10.9	12	9.8
				July 7	11.2	12.3	10	Aug 7	12.5	13.4	11.4	Sept 7	11.4	12.3	10.5
				July 8	11.0	11.8	10.3	Aug8	12.2	13	11.5	Sept 8	11.3	12.1	10.5
				July 9	10.7	11.6	9.8	Aug9	11.0	11.6	10.3	Sept 9	10.4	11.3	9.4
				July 10	10.6	11.6	9.7	Aug10	11.0	12.3	9.7	Sept 10	9.9	10.5	9.2
				July 11	10.4	11.2	9.4	Aug 11	11.4	12.6	10.2	Sept 11	9.6	10.5	8.8
				July 12	10.4	11.3	9.4	Aug 12	11.6	12.3	11.1	Sept 12	8.8	9.7	7.7
				July 13	10.4	11.6	9	Aug13	11.5	12.5	10.6				
June 14	8.8	9.8	7.9	July 14	10.5	11.2	9.9	Aug 14	11.8	13.4	10.3				
June 15	8.8	9.9	7.8	July 15	10.5	11.5	9.5	Aug15	12.0	13.4	10.5				
June 16	8.7	9.6	7.7	July 16	11.1	12.8	9.5	Aug 16	12.1	13.1	11.1				
June 17	8.8	9.8	7.8	July 17	11.2	12.3	9.7	Aug 17	12.3	13.7	11				
June 18	9.5	10.5	8.7	July 18	11.9	13.1	10.9	Aug18	12.5	13.4	11.3				
June 19	9.3	10.5	8.1	July 19	12.0	12.8	10.8	Aug 19	12.7	14	11.4				
June 20	9.5	10.5	8.5	July 20	11.8	13.3	10.6	Aug 20	12.4	13.4	11.2				
June 21	9.2	9.9	8.1	July 21	11.9	13.4	10.6	Aug 21	12.1	12.8	11.1				
June 22	8.9	9.5	8.5	July 22	11.7	12.4	10.9	Aug 22	12.1	13	11.2				
June 23	8.8	9.9	7.9	July 23	12.0	12.8	11.2	Aug 23	11.7	12.3	11.5				
June 24	9.4	10.4	8.2	July 24	12.0	12.7	11.2	Aug 24	10.8	11.3	10.3				
June 25	9.7	10.5	8.8	July 25	12.6	13.8	11.3	Aug 25	11.2	12.1	10.4				
June 26	9.5	10.2	8.5	July 26	12.7	14.2	11.3	Aug 26	10.9	11.8	9.9				
June 27	9.2	9.6	8.6	July 27	12.2	12.9	11.6	Aug 27	10.9	11.4	10.3				
June 28	9.2	9.9	8.8	July 28	11.7	12	11.5	Aug 28	10.9	11.7	10.2				
June 29	9.5	10.3	8.8	July 29	10.9	11.4	10.5	Aug 29	10.4	11.6	9.1				
June 30	10.3	11.3	9.3	July 30	10.6	11.6	9.7	Aug 30	10.7	11.8	9.5				
				July 31	11.5	12.6	10.5	Aug 31	11.6	12.4	10.8				

Blackpine Water Temperatures 1993



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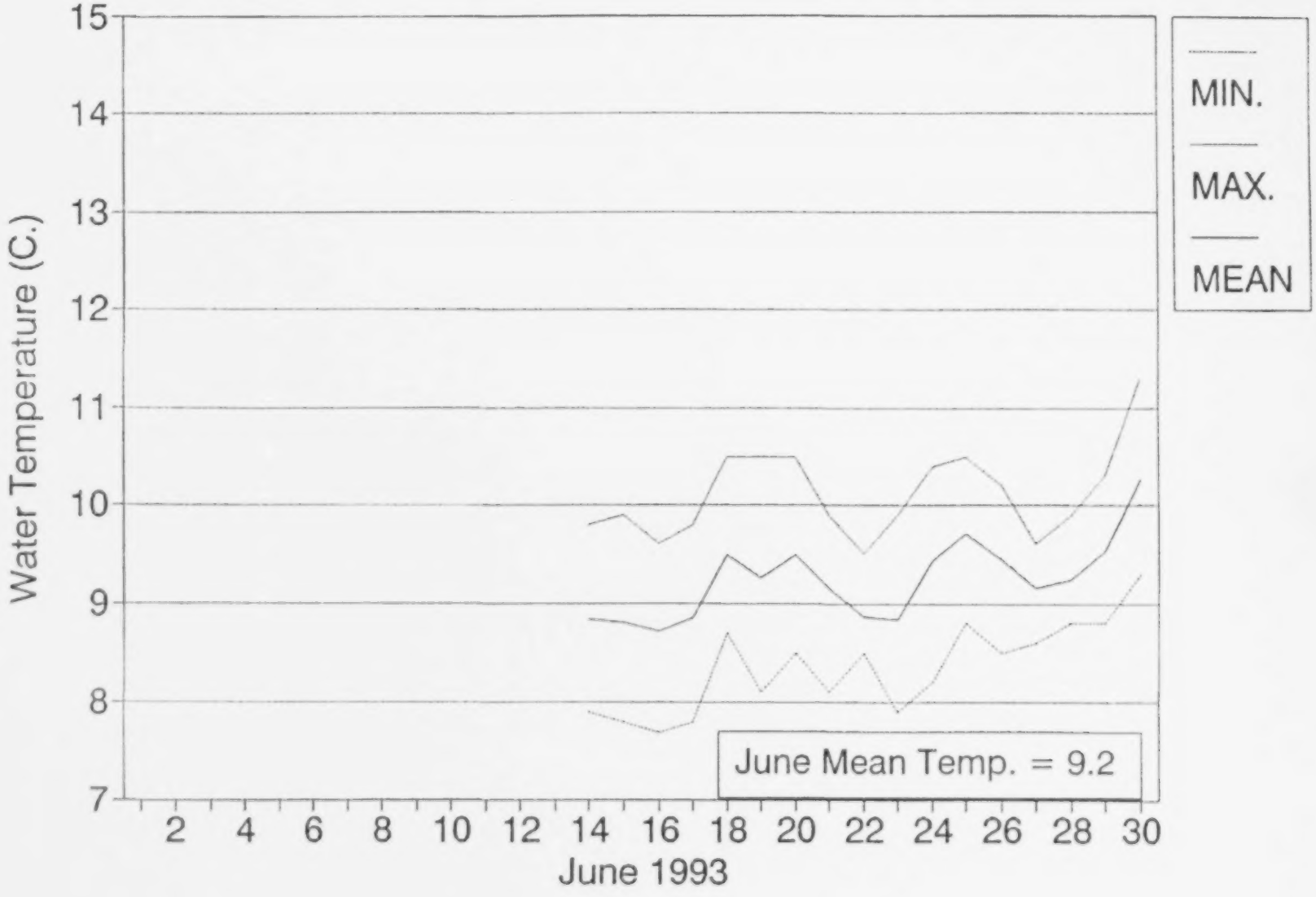

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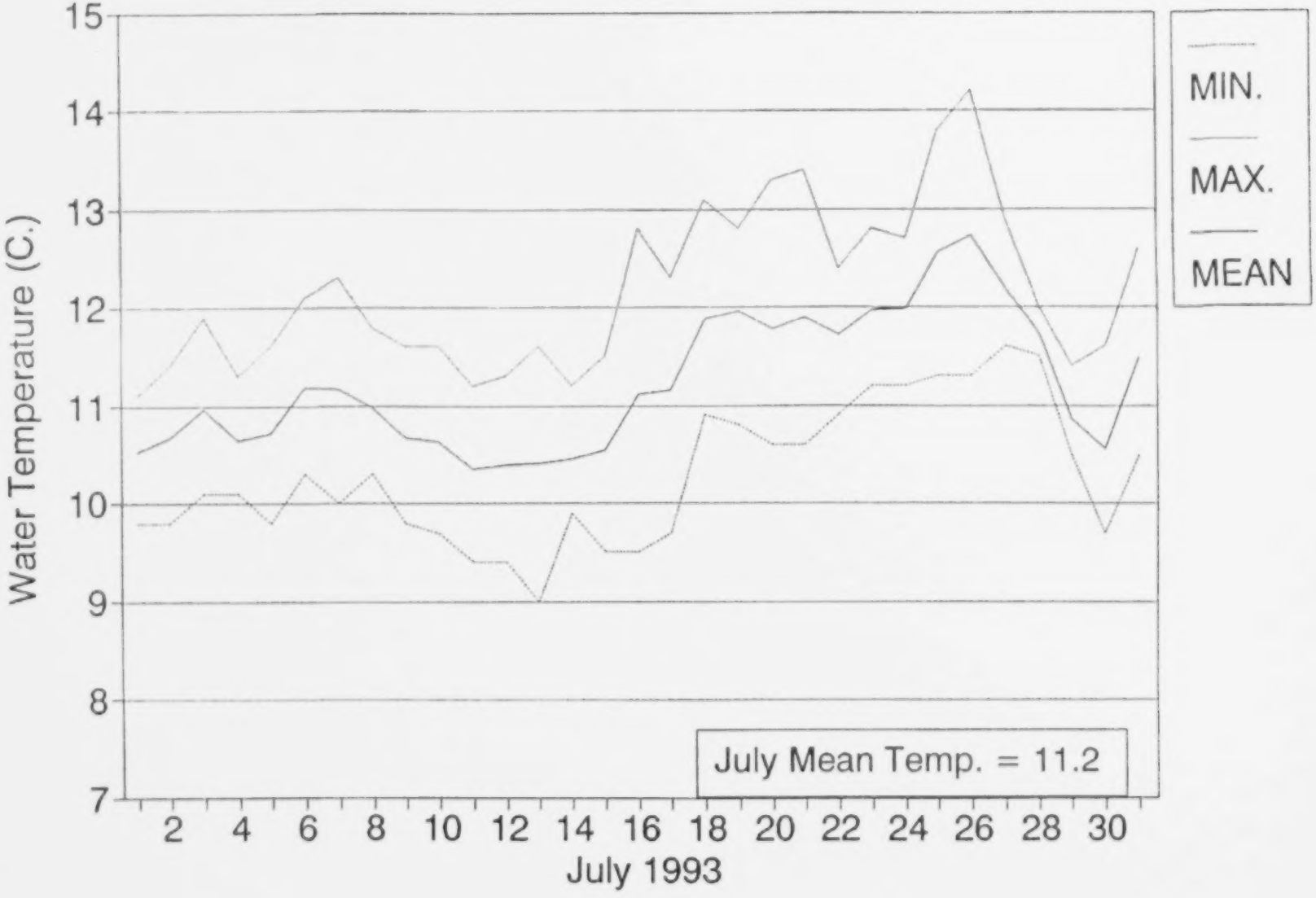

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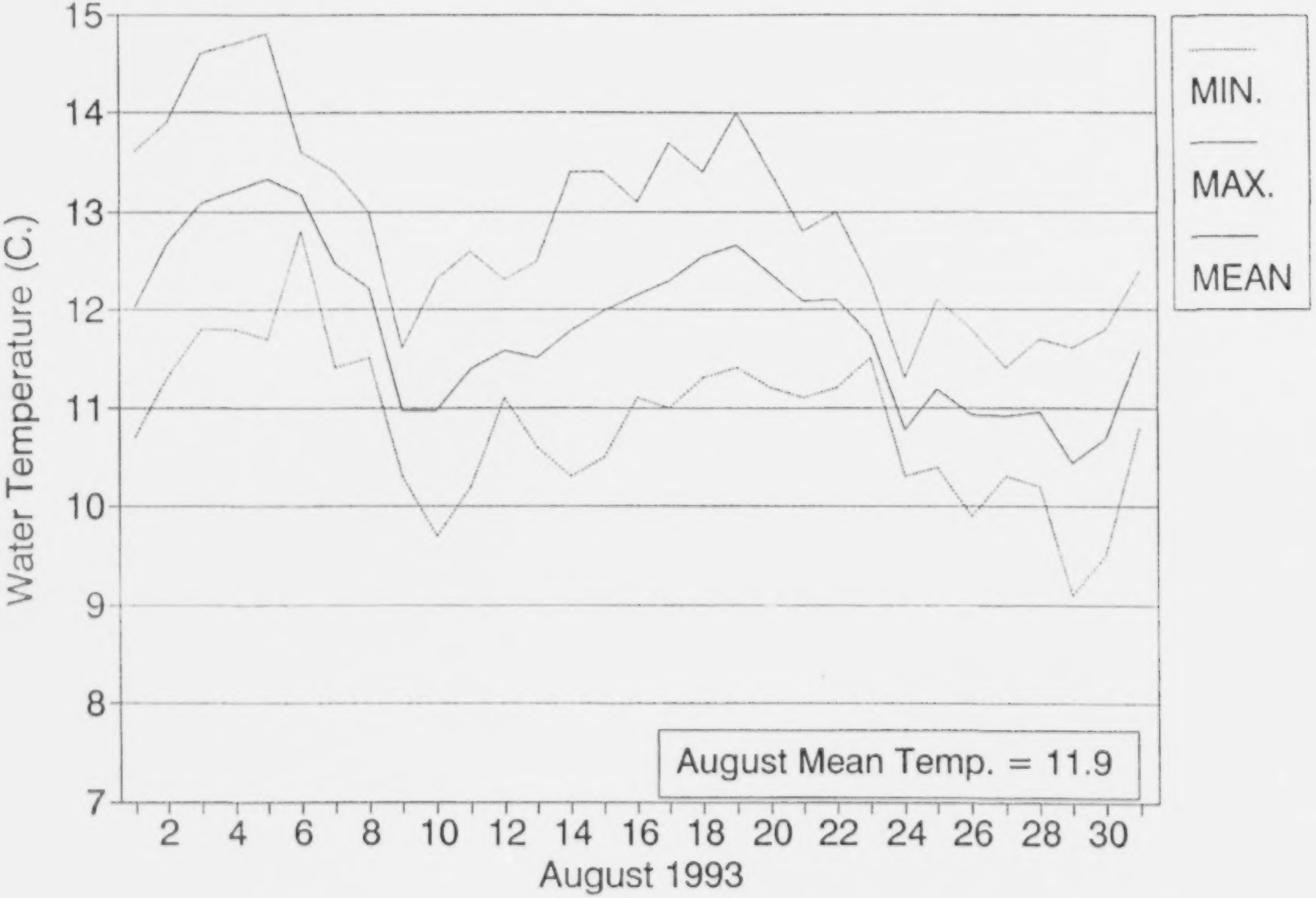
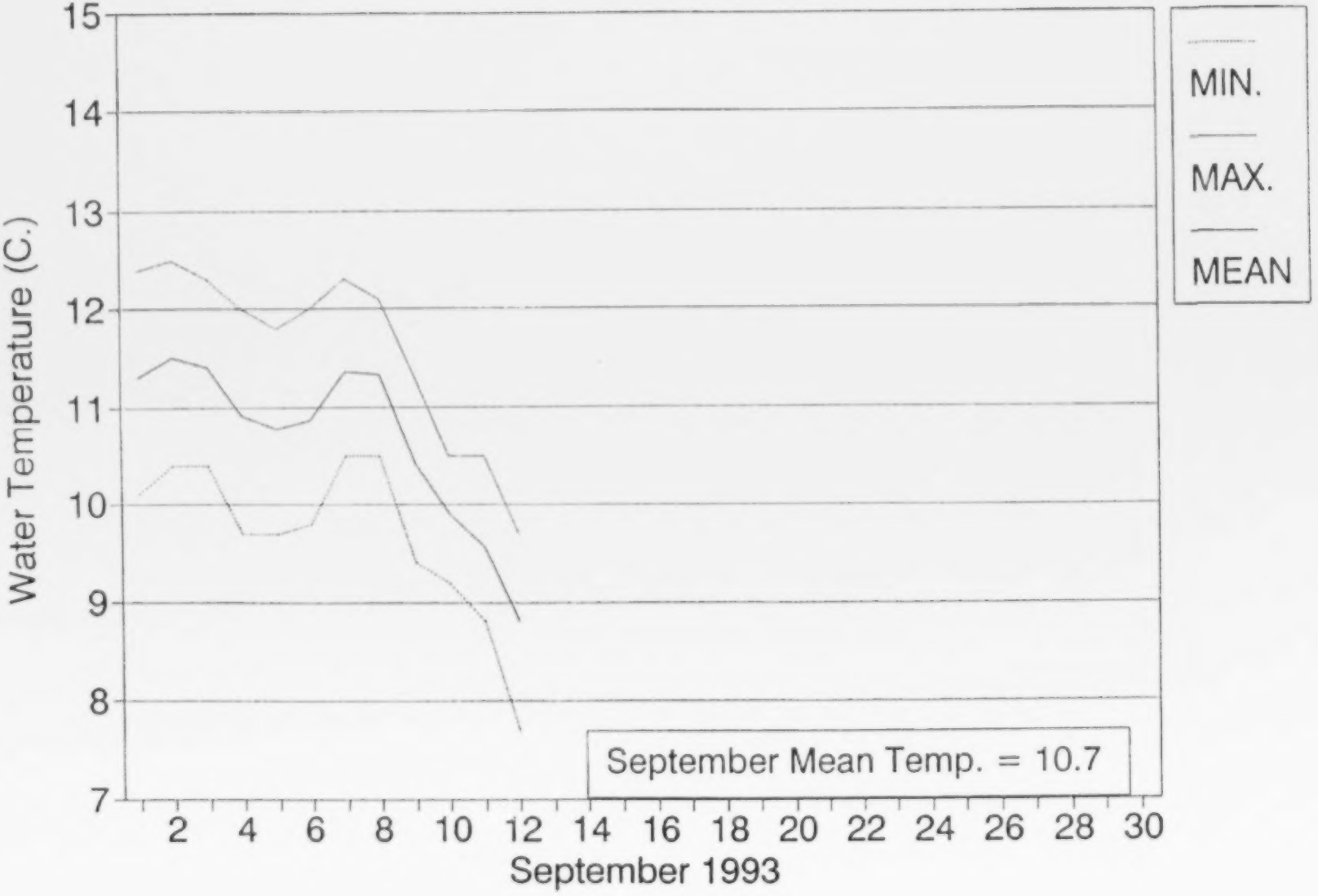


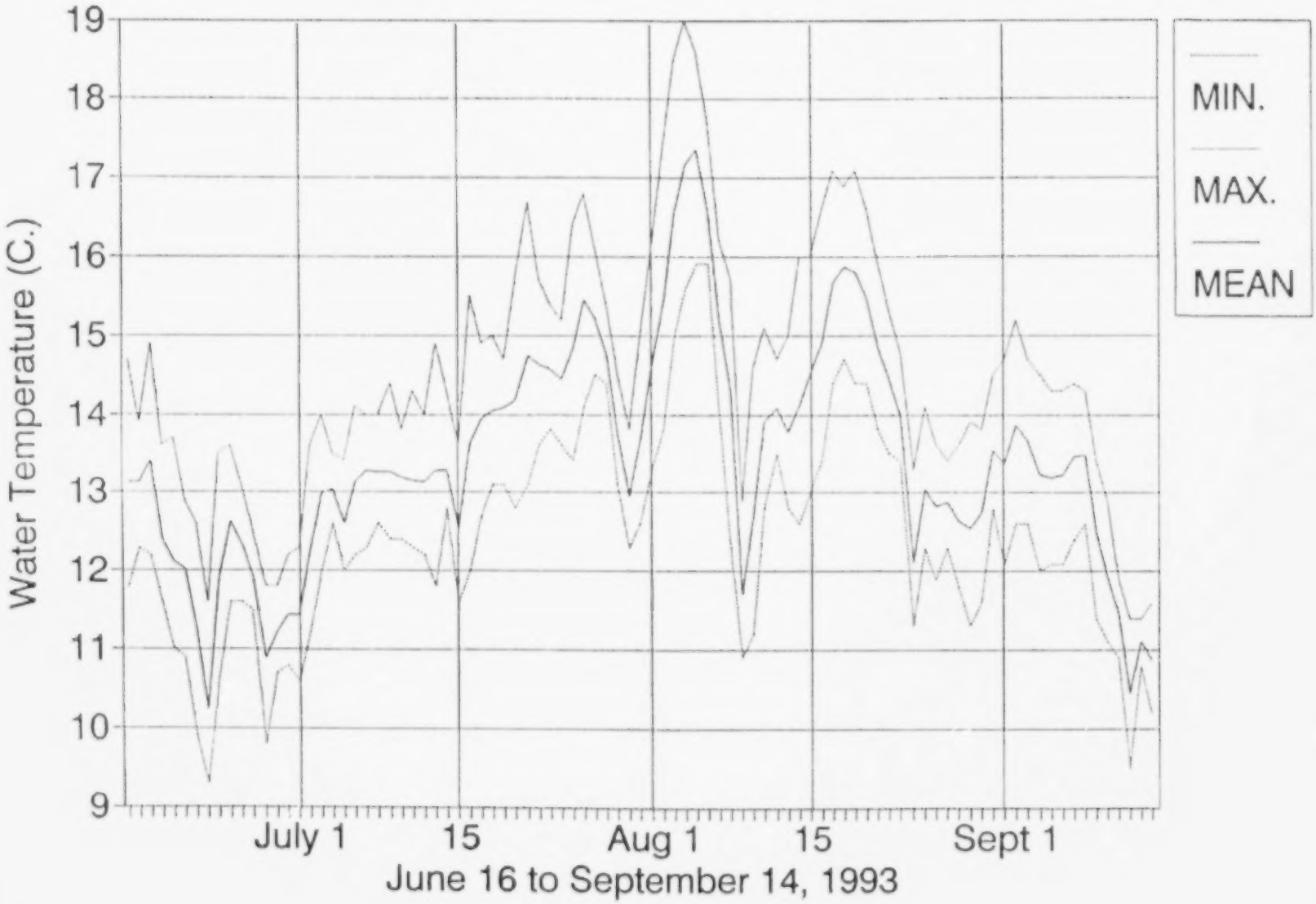
Blackpine Water Temperatures 1993



CARINA CREEK WATER TEMPERATURES 1993

DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.
				July 1	11.4	12.3	10.6	Aug 1	14.7	16.2	13.3	Sept 1	13.4	14.7	12.1
				July 2	12.3	13.6	11.2	Aug 2	15.4	17.4	13.8	Sept 2	13.9	15.2	12.6
				July 3	13.0	14	12	Aug 3	16.6	18.5	15	Sept 3	13.7	14.7	12.6
				July 4	13.0	13.5	12.6	Aug 4	17.2	19	15.6	Sept 4	13.2	14.5	12
				July 5	12.6	13.4	12	Aug 5	17.4	18.6	15.9	Sept 5	13.2	14.3	12.1
				July 6	13.1	14.1	12.2	Aug 6	16.6	17.7	15.9	Sept 6	13.2	14.3	12.1
				July 7	13.3	14	12.3	Aug 7	15.2	16.2	14	Sept 7	13.5	14.4	12.4
				July 8	13.3	14	12.6	Aug 8	14.3	15.7	12.3	Sept 8	13.5	14.3	12.6
				July 9	13.3	14.4	12.4	Aug 9	11.7	12.9	10.9	Sept 9	12.5	13.4	11.4
				July 10	13.2	13.8	12.4	Aug 10	12.7	14.6	11.2	Sept 10	11.9	12.9	11.1
				July 11	13.2	14.3	12.3	Aug 11	13.9	15.1	12.8	Sept 11	11.5	11.9	10.9
				July 12	13.1	14	12.2	Aug 12	14.1	14.7	13.5	Sept 12	10.4	11.4	9.5
				July 13	13.3	14.9	11.8	Aug 13	13.8	15	12.8	Sept 13	11.1	11.4	10.8
				July 14	13.3	14.3	12.8	Aug 14	14.1	16	12.6	Sept 14	10.9	11.6	10.2
				July 15	12.6	13.6	11.6	Aug 15	14.5	16	13				
June 16	13.1	14.7	11.8	July 16	13.6	15.5	12	Aug 16	14.9	16.6	13.4				
June 17	13.1	13.9	12.3	July 17	13.9	14.9	12.7	Aug 17	15.7	17.1	14.4				
June 18	13.4	14.9	12.2	July 18	14.1	15	13.1	Aug 18	15.9	16.9	14.7				
June 19	12.4	13.6	11.6	July 19	14.1	14.7	13.1	Aug 19	15.8	17.1	14.4				
June 20	12.1	13.7	11	July 20	14.2	15.7	12.8	Aug 20	15.5	16.6	14.4				
June 21	12.0	12.9	10.9	July 21	14.7	16.7	13.1	Aug 21	14.9	15.9	13.8				
June 22	11.3	12.6	9.9	July 22	14.6	15.7	13.6	Aug 22	14.4	15.3	13.5				
June 23	10.2	11.6	9.3	July 23	14.6	15.4	13.8	Aug 23	14.0	14.8	13.4				
June 24	11.9	13.5	10.6	July 24	14.4	15.2	13.6	Aug 24	12.1	13.3	11.3				
June 25	12.6	13.6	11.6	July 25	14.8	16.4	13.4	Aug 25	13.0	14.1	12.3				
June 26	12.4	13.1	11.6	July 26	15.5	16.8	14.1	Aug 26	12.8	13.6	11.9				
June 27	11.9	12.5	11.5	July 27	15.2	16.1	14.5	Aug 27	12.9	13.4	12.3				
June 28	10.9	11.8	9.8	July 28	14.8	15.4	14.4	Aug 28	12.6	13.6	11.8				
June 29	11.2	11.8	10.7	July 29	13.8	14.5	13.1	Aug 29	12.6	13.9	11.3				
June 30	11.4	12.2	10.8	July 30	13.0	13.8	12.3	Aug 30	12.7	13.8	11.6				
				July 31	13.7	15	12.6	Aug 31	13.5	14.5	12.8				

Carina Water Temperatures 1993



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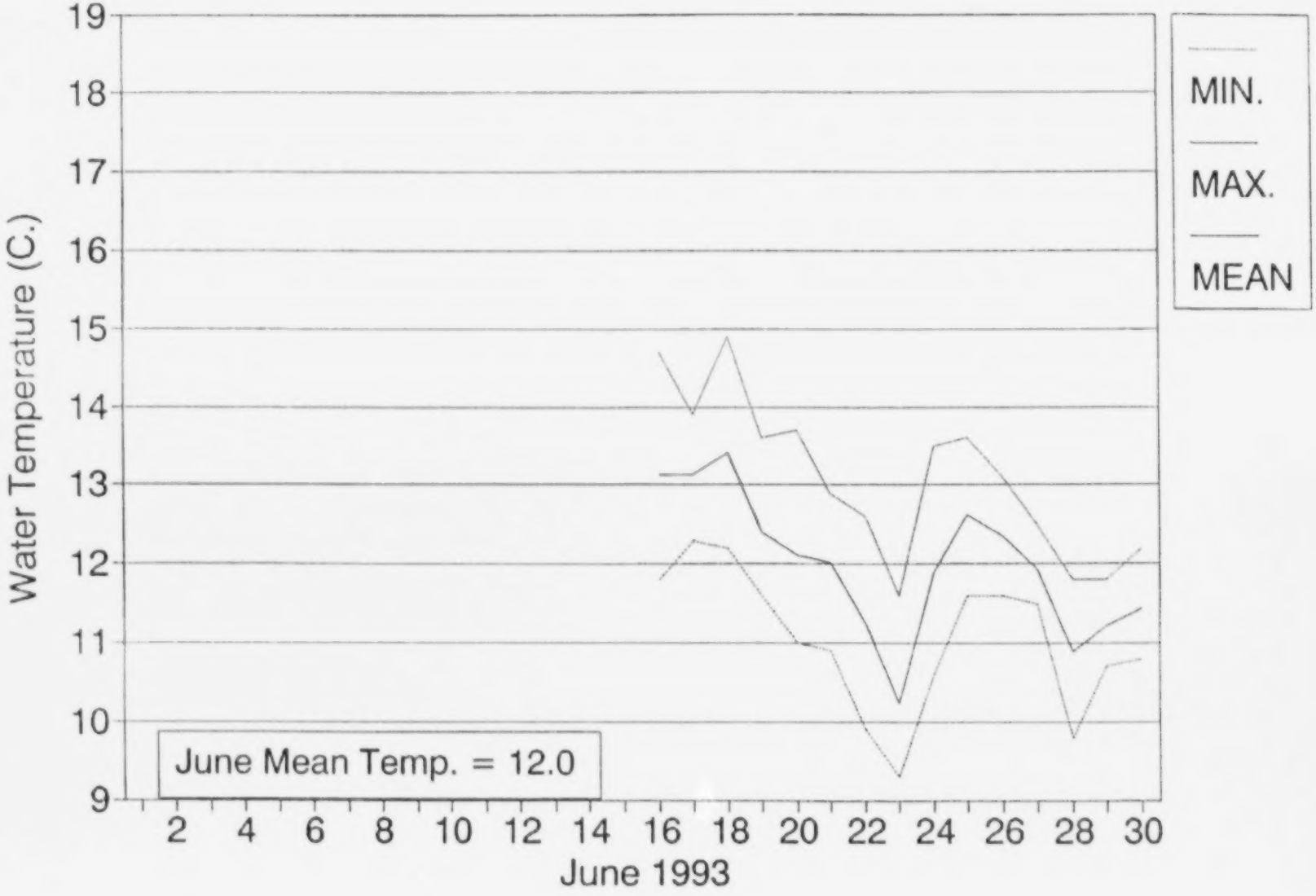

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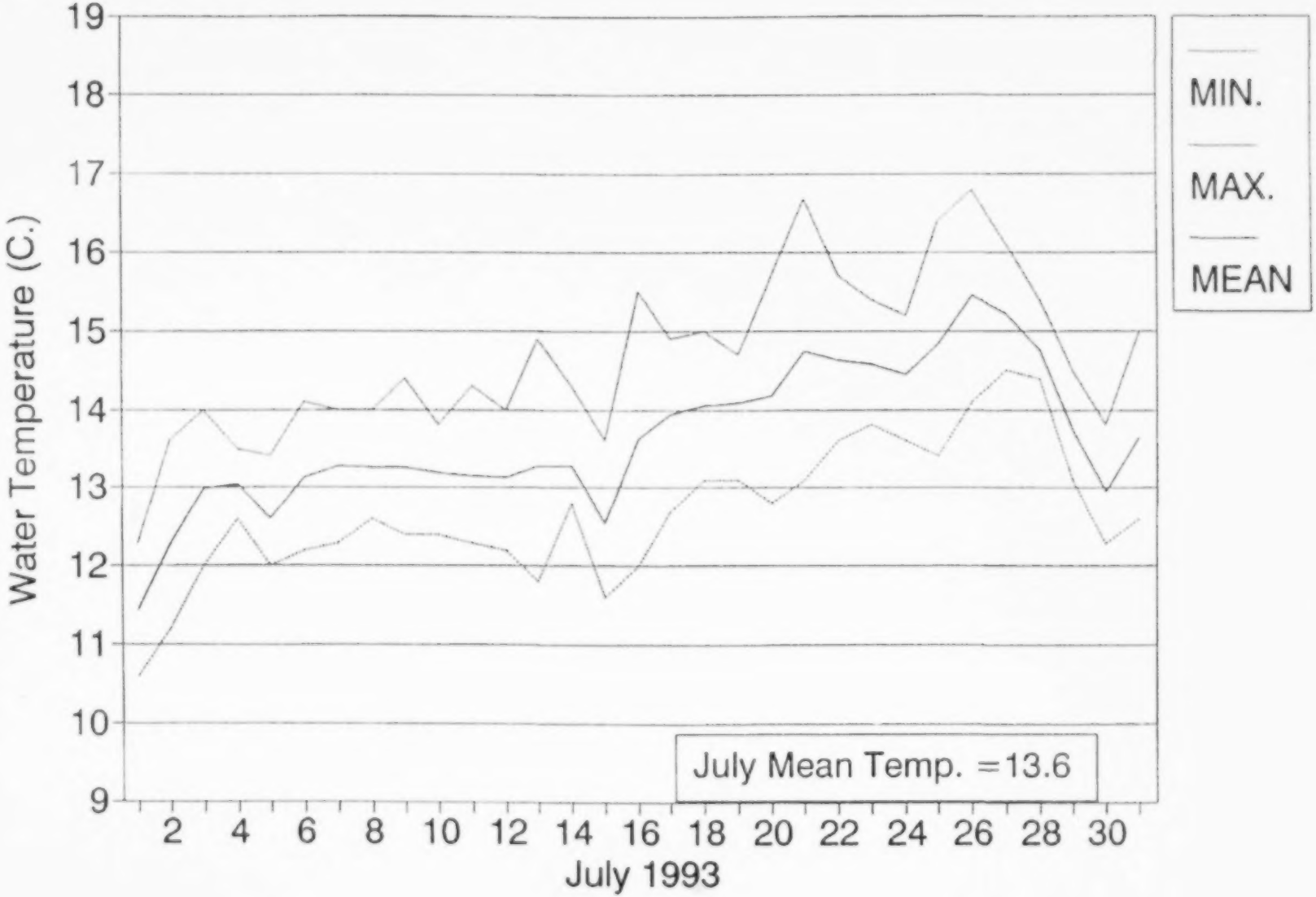
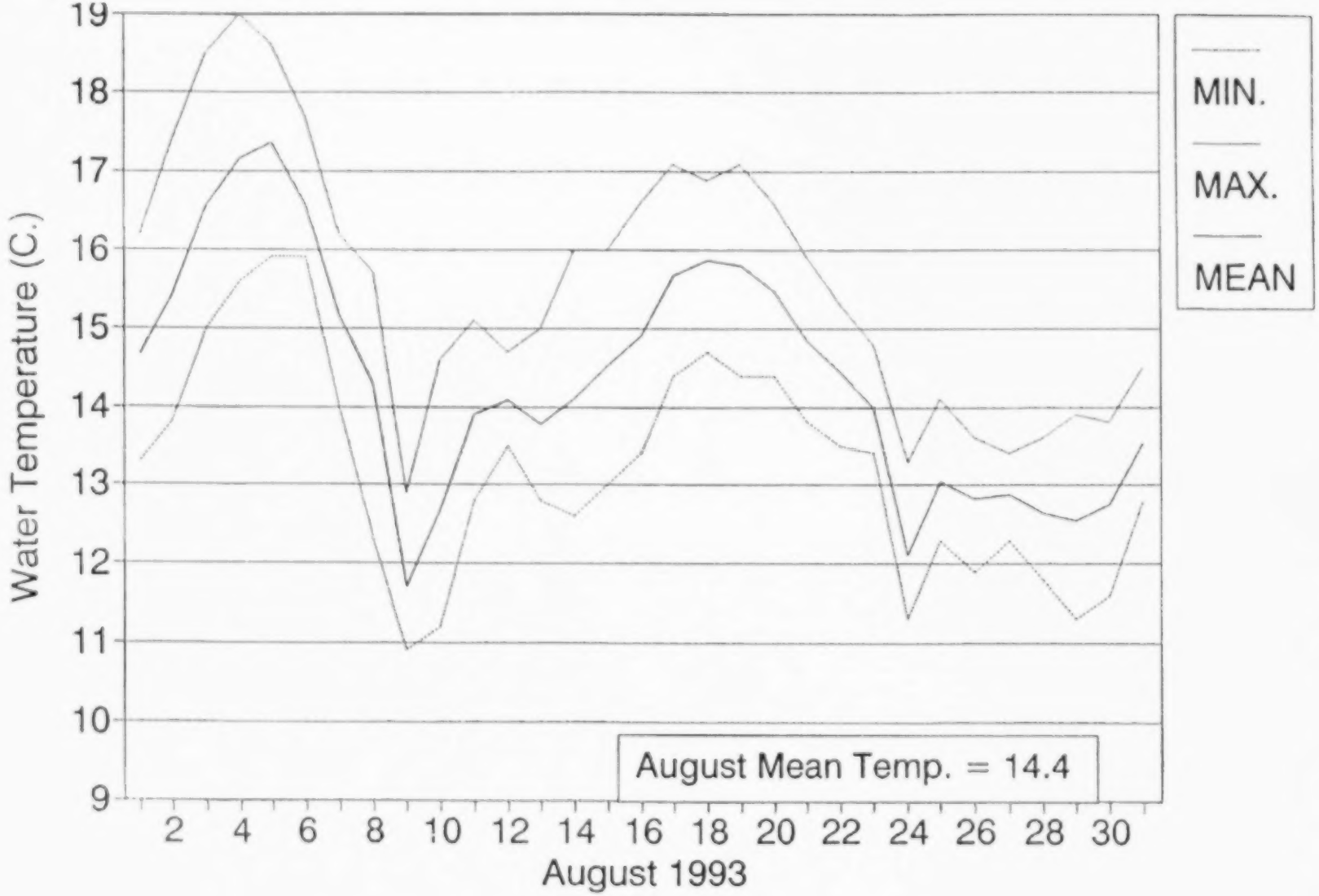


Carina Water Temperatures 1993



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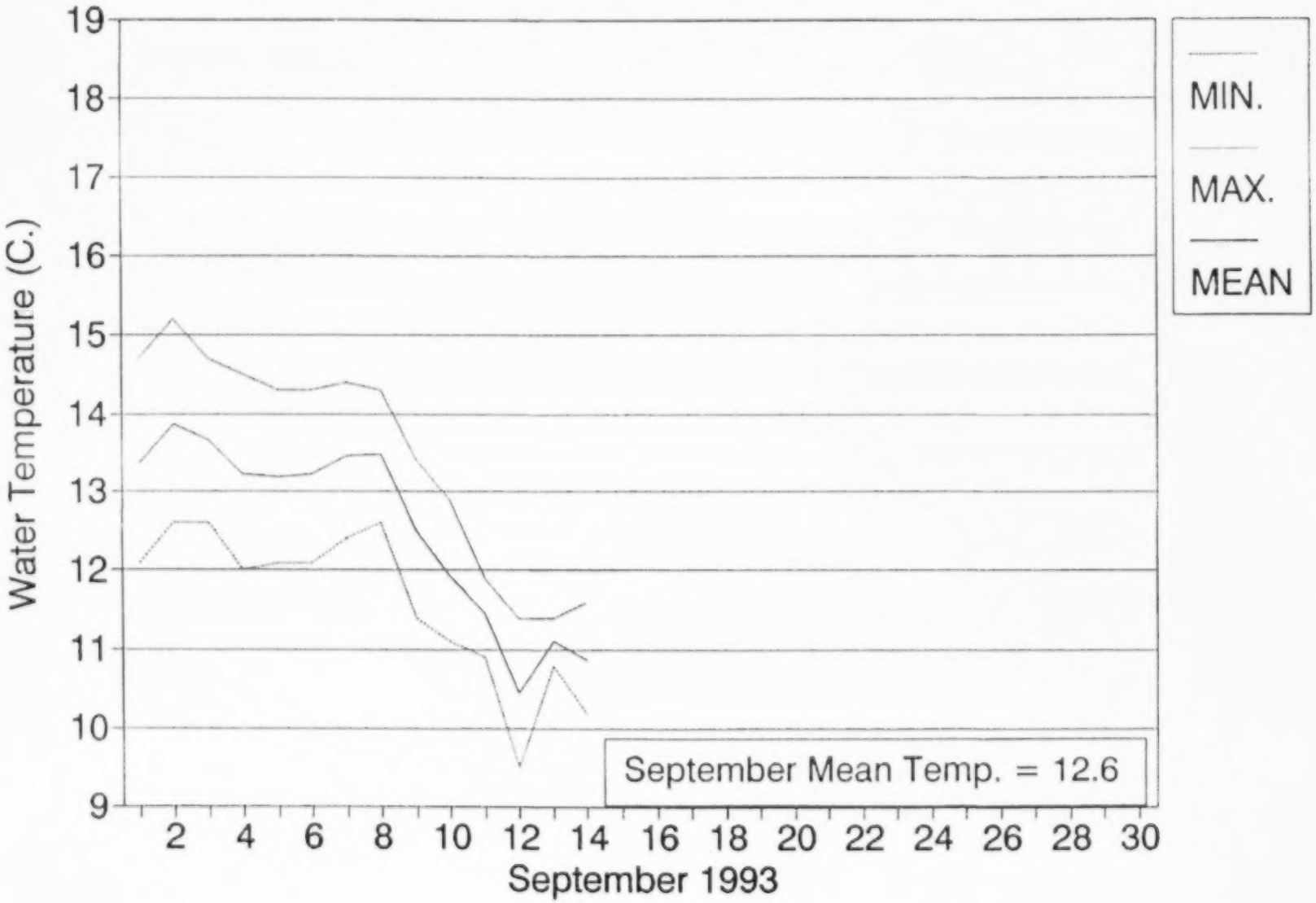
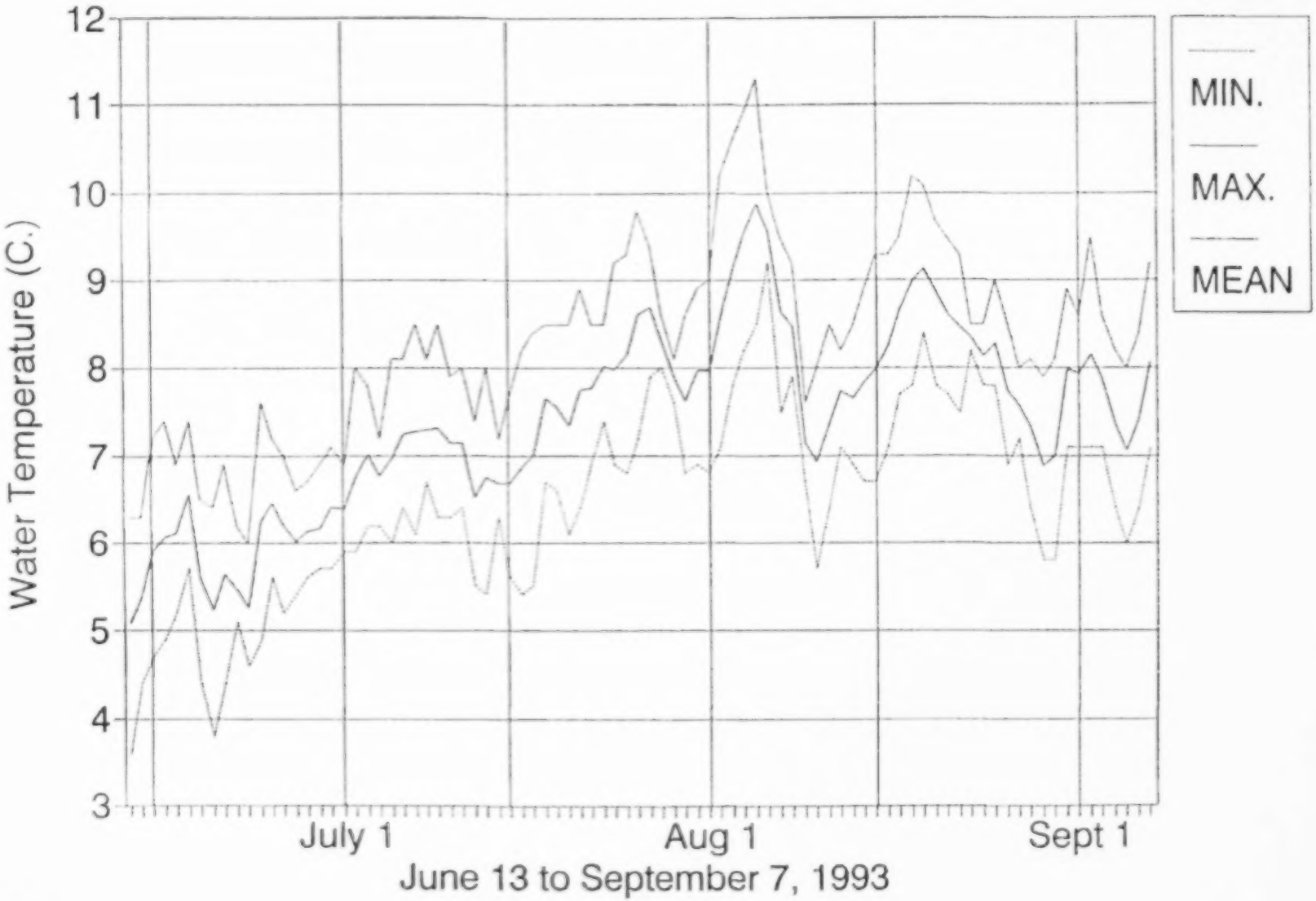


CONTROL CREEK WATER TEMPERATURES 1993

DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.
				July 1	6.4	6.9	5.9	Aug1	8.0	9	6.8	Sept 1	7.9	8.6	7.1
				July 2	6.8	8	5.9	Aug 2	8.6	10.2	7.1	Sept 2	8.2	9.5	7.1
				July 3	7.0	7.8	6.2	Aug3	9.1	10.6	7.8	Sept 3	7.9	8.6	7.1
				July 4	6.8	7.2	6.2	Aug 4	9.5	10.9	8.2	Sept 4	7.4	8.2	6.4
				July 5	7.0	8.1	6	Aug 5	9.9	11.3	8.5	Sept 5	7.1	g	6
				July 6	7.2	8.1	6.4	Aug 6	9.6	10	9.2	Sept 6	7.4	8.4	6.4
				July 7	7.3	8.5	6.1	Aug 7	8.6	9.5	7.5	Sept 7	8.1	9.2	7.1
				July 8	7.3	8.1	6.7	Aug 8	8.5	9.2	7.9				
				July 9	7.3	8.5	6.3	Aug 9	7.1	7.6	6.7				
				July 10	7.2	7.9	6.3	Aug10	6.9	8	5.7				
				July 11	7.1	8	6.4	Aug 11	7.4	8.5	6.4				
				July 12	6.5	7.4	5.5	Aug 12	7.7	8.2	7.1				
June 13	5.1	6.3	3.6	July 13	6.8	8	5.4	Aug13	7.7	8.5	6.9				
June 14	5.4	6.3	4.4	July 14	6.7	7.2	6.3	Aug 14	7.8	8.9	6.7				
June 15	5.9	7.2	4.7	July 15	6.7	7.7	5.6	Aug15	8.0	9.3	6.7				
June 16	6.1	7.4	4.9	July 16	6.9	8.2	5.4	Aug 16	8.2	9.3	7.1				
June 17	6.1	6.9	5.2	July 17	7.0	8.4	5.5	Aug 17	8.7	9.5	7.7				
June 18	6.6	7.4	5.7	July 18	7.7	8.5	6.7	Aug18	9.0	10.2	7.8				
June 19	5.6	6.5	4.4	July 19	7.6	8.5	6.6	Aug 19	9.1	10.1	8.4				
June 20	5.2	6.4	3.8	July 20	7.4	8.5	6.1	Aug 20	8.9	9.7	7.8				
June 21	5.6	6.9	4.4	July 21	7.8	8.9	6.4	Aug 21	8.6	9.5	7.7				
June 22	5.5	6.2	5.1	July 22	7.8	8.5	6.9	Aug 22	8.5	9.3	7.5				
June 23	5.3	6	4.6	July 23	8.0	8.5	7.4	Aug 23	8.3	8.5	8.2				
June 24	6.2	7.6	4.9	July 24	8.0	9.2	6.9	Aug 24	8.1	8.5	7.8				
June 25	6.5	7.2	5.6	July 25	8.1	9.3	6.8	Aug 25	8.3	9	7.8				
June 26	6.2	7	5.2	July 26	8.6	9.8	7.2	Aug 26	7.7	8.5	6.9				
June 27	6.0	6.6	5.4	July 27	8.7	9.4	7.9	Aug 27	7.6	8	7.2				
June 28	6.1	6.7	5.6	July 28	8.3	8.6	8	Aug 28	7.3	8.1	6.4				
June 29	6.2	6.9	5.7	July 29	7.9	8.1	7.6	Aug 29	6.9	7.9	5.8				
June 30	6.4	7.1	5.7	July 30	7.6	8.6	6.8	Aug 30	7.0	8.1	5.8				
				July 31	8.0	8.9	6.9	Aug 31	8.0	8.9	7.1				

Control Water Temperatures 1993



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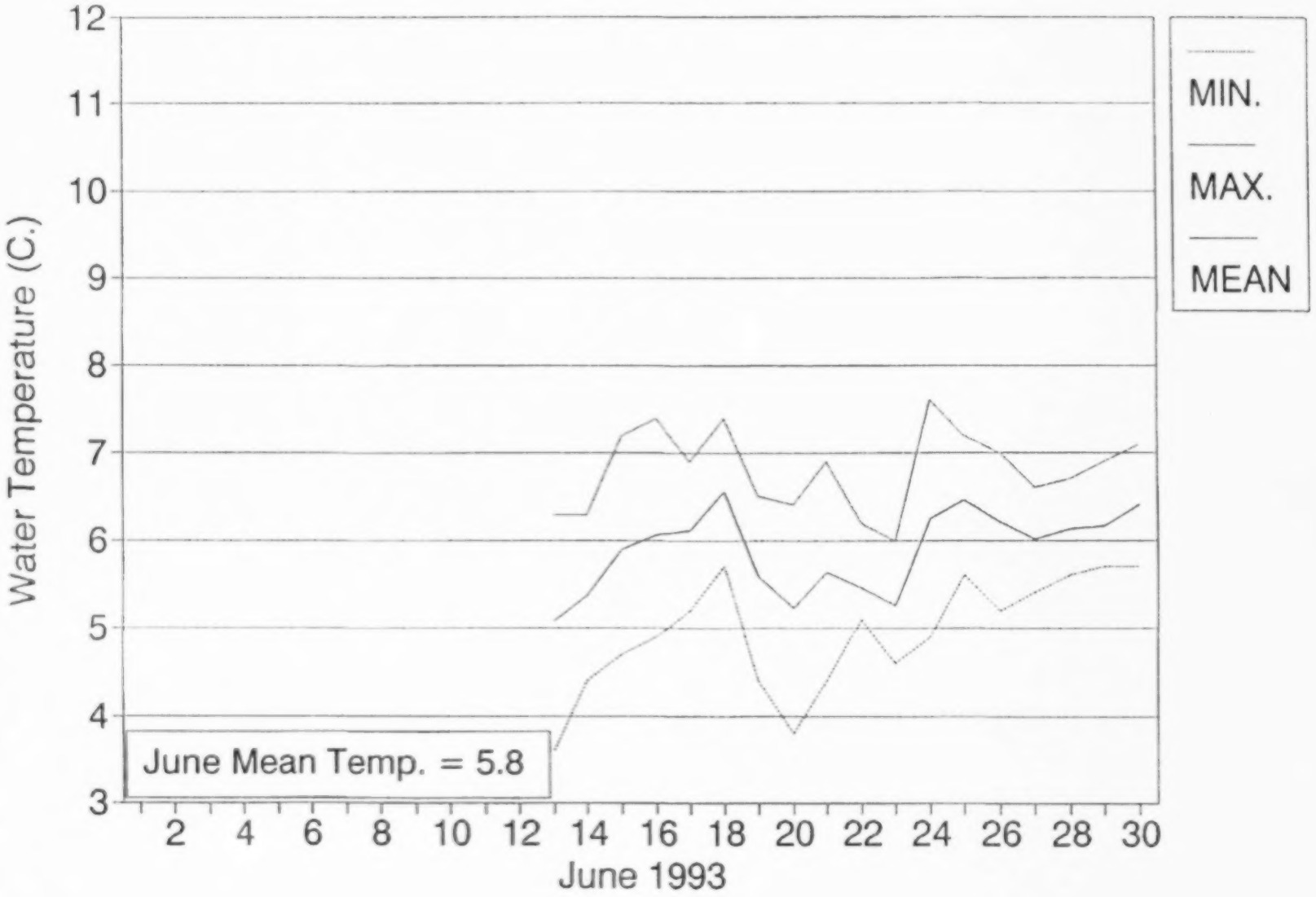
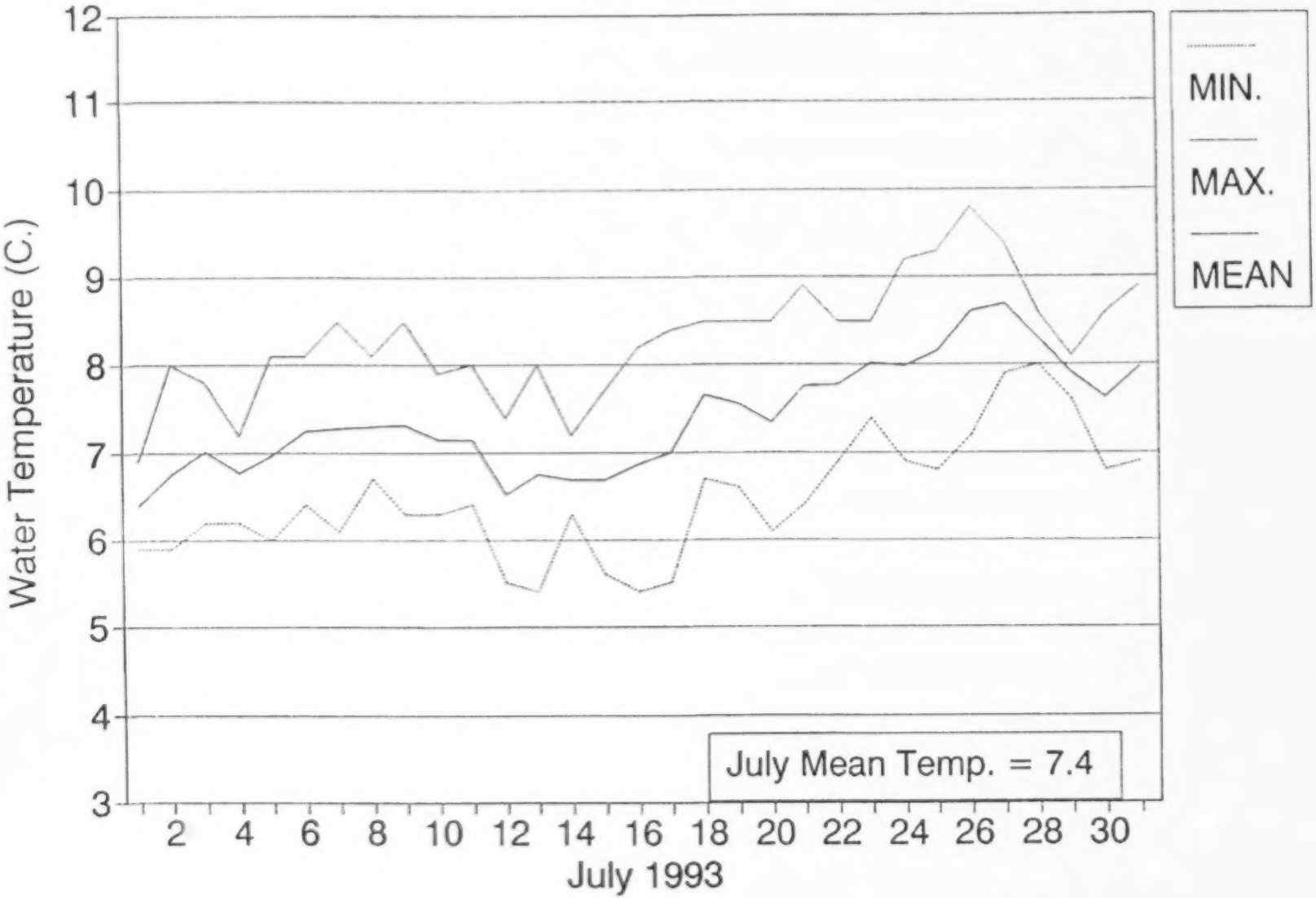
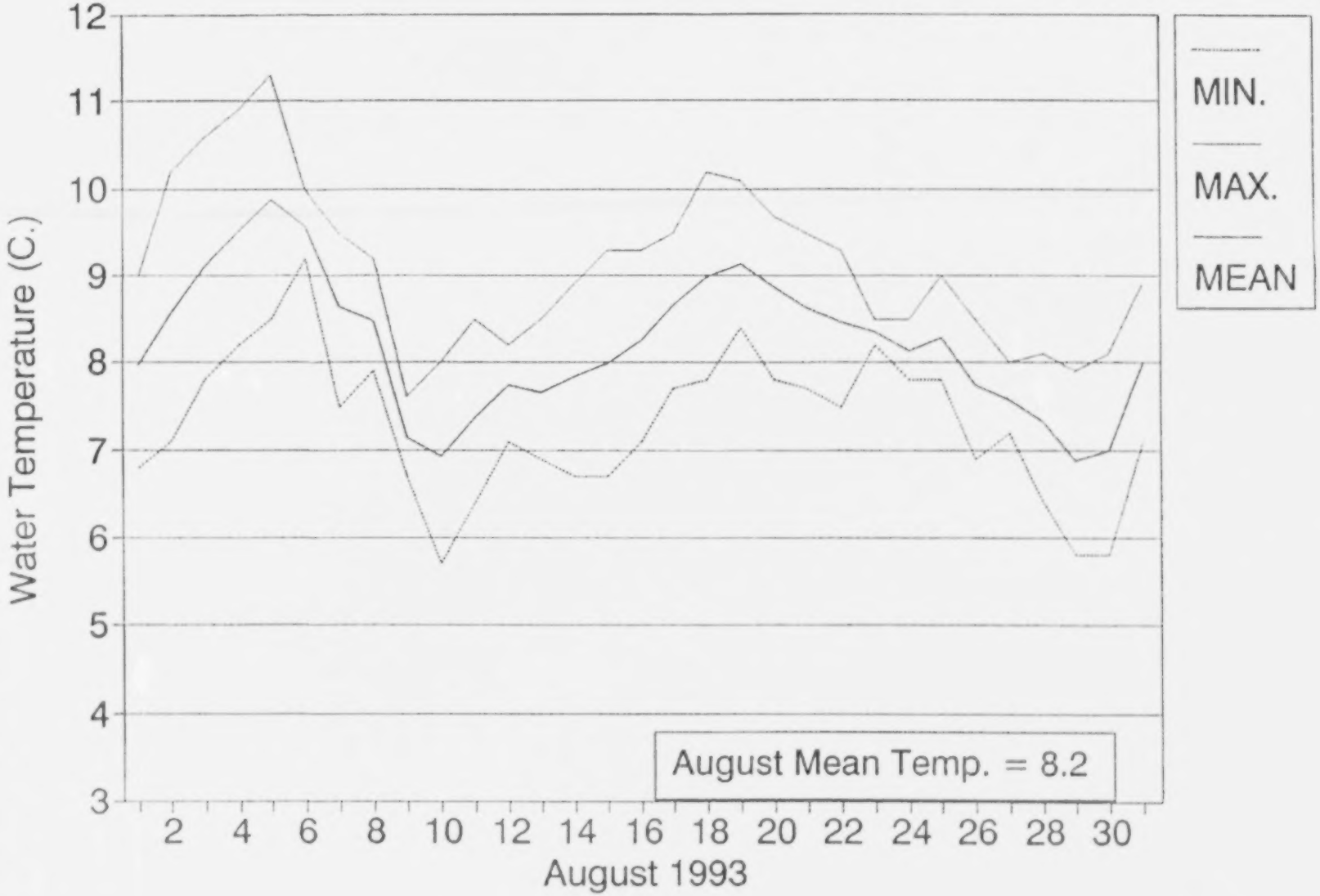


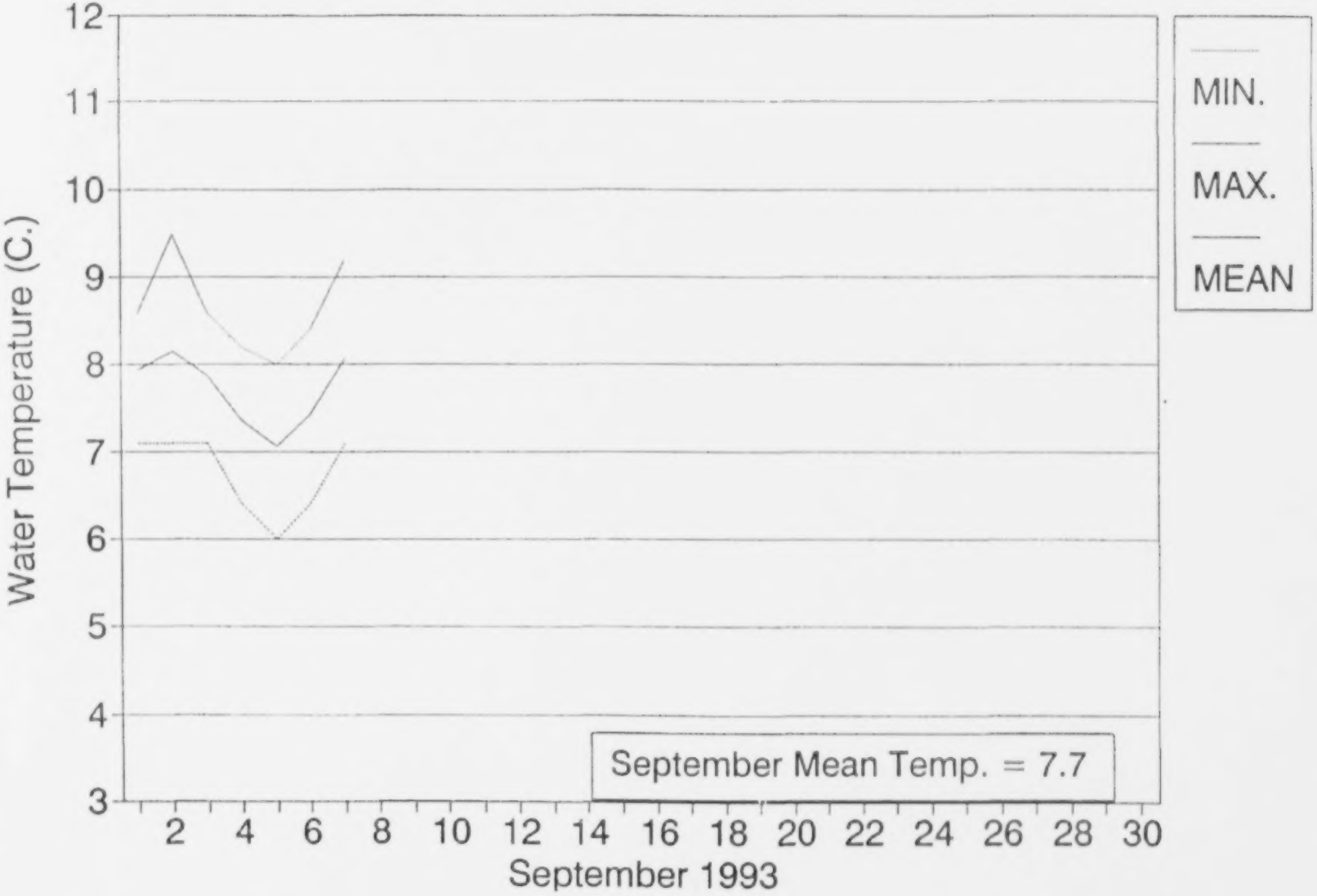
Control Water Temperatures 1993



Control Water Temperatures 1993



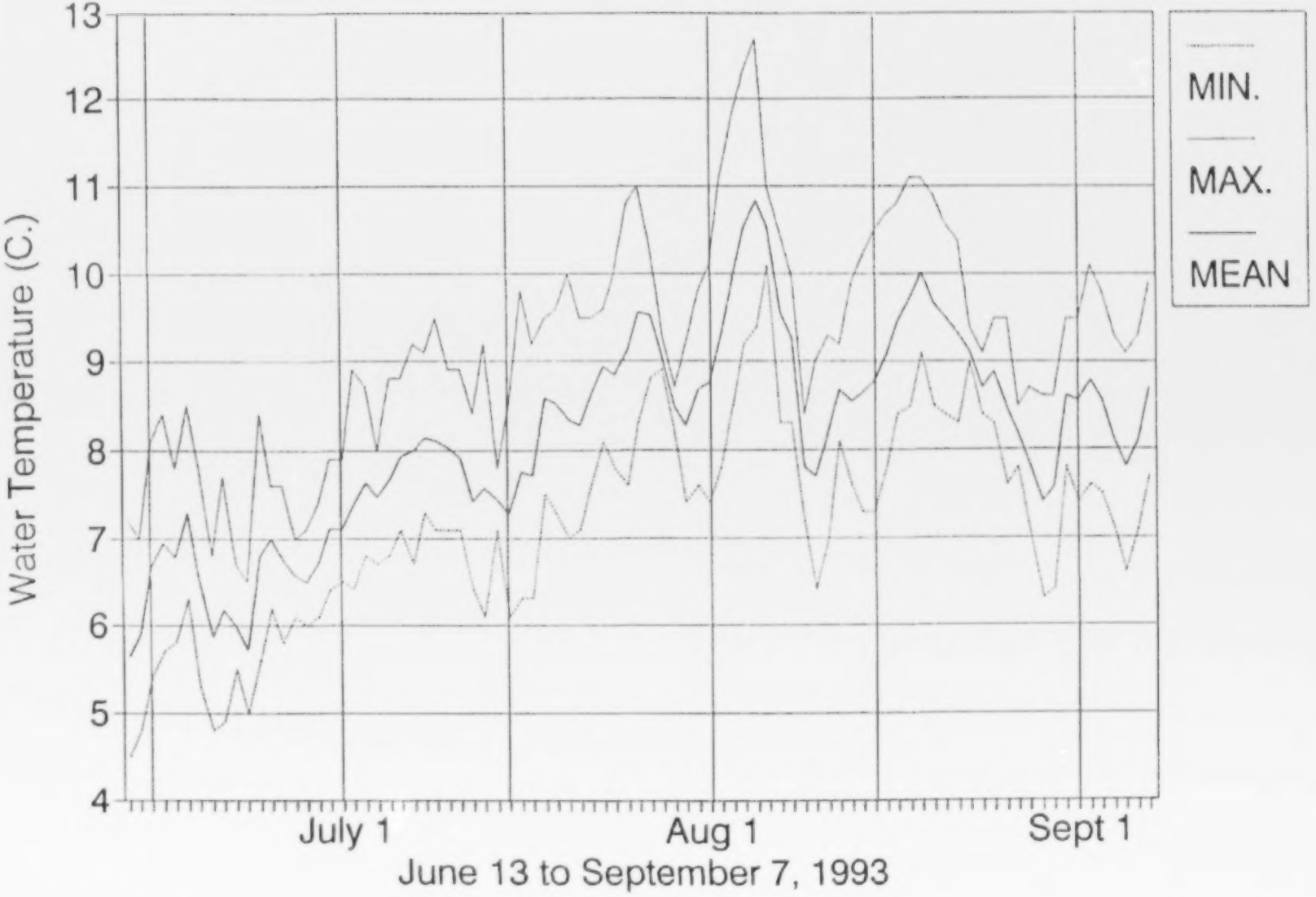
Control Water Temperatures 1993



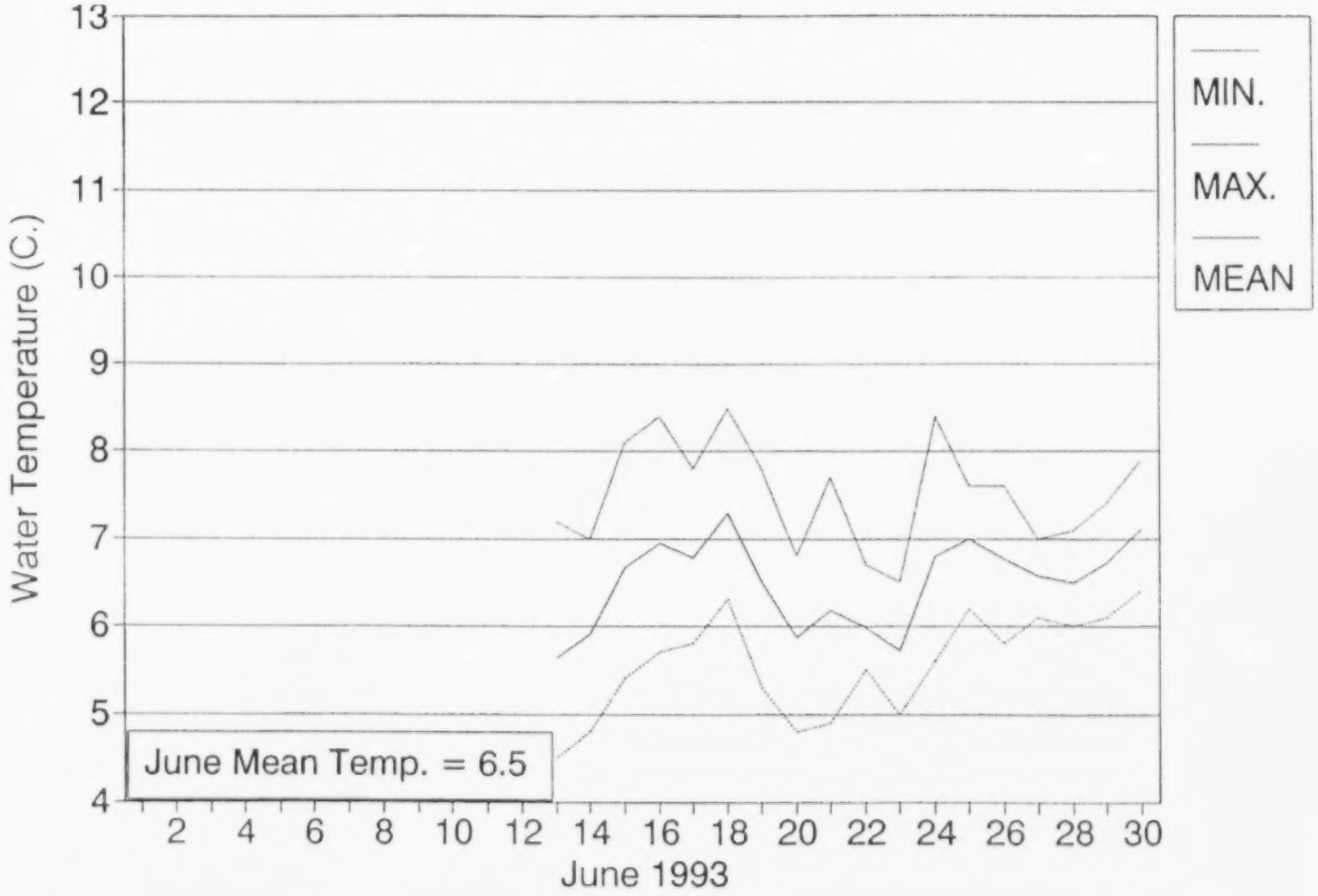
CULVERT CREEK WATER TEMPERATURES 1993

DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.
				July 1	7.1	7.9	6.5	Aug1	8.8	10.1	7.4	Sept 1	8.6	9.5	7.4
				July 2	7.4	8.9	6.4	Aug2	9.3	11.1	7.8	Sept 2	8.8	10.1	7.6
				July 3	7.6	8.7	6.8	Aug3	10.0	11.8	8.5	Sept 3	8.6	9.8	7.5
				July 4	7.5	8	6.7	Aug 4	10.5	12.3	9.2	Sept 4	8.1	9.3	7.1
				July 5	7.7	8.8	6.8	Aug5	10.8	12.7	9.4	Sept 5	7.8	9.1	6.6
				July 6	7.9	8.8	7.1	Aug6	10.6	11	10.1	Sept 6	8.1	9.3	7.1
				July 7	8.0	9.2	6.7	Aug7	9.6	10.5	8.3	Sept 7	8.7	9.9	7.7
				July 8	8.1	9.1	7.3	Aug8	9.3	10	8.3				
				July 9	8.1	9.5	7.1	Aug9	7.8	8.4	7.2				
				July 10	8.0	8.9	7.1	Aug10	7.7	9	6.4				
				July 11	7.9	8.9	7.1	Aug11	8.2	9.3	7				
				July 12	7.4	8.4	6.4	Aug 12	8.7	9.2	8.1				
June 13	5.6	7.2	4.5	July 13	7.6	9.2	6.1	Aug 13	8.5	9.9	7.6				
June 14	5.9	7	4.8	July 14	7.4	7.8	7.1	Aug 14	8.6	10.2	7.3				
June 15	6.7	8.1	5.4	July 15	7.3	8.5	6.1	Aug15	8.8	10.5	7.3				
June 16	6.9	8.4	5.7	July 16	7.8	9.8	6.3	Aug 16	9.1	10.7	7.8				
June 17	6.8	7.8	5.8	July 17	7.7	9.2	6.3	Aug 17	9.5	10.8	8.4				
June 18	7.3	8.5	6.3	July 18	8.6	9.5	7.5	Aug18	9.7	11.1	8.5				
June 19	6.5	7.8	5.3	July 19	8.5	9.6	7.3	Aug 19	10.0	11.1	9.1				
June 20	5.9	6.8	4.8	July 20	8.3	10	7	Aug 20	9.7	10.9	8.5				
June 21	6.2	7.7	4.9	July 21	8.3	9.5	7.1	Aug 21	9.5	10.6	8.4				
June 22	6.0	6.7	5.5	July 22	8.6	9.5	7.6	Aug 22	9.3	10.4	8.3				
June 23	5.7	6.5	5	July 23	8.9	9.6	8.1	Aug 23	9.1	9.4	9				
June 24	6.8	8.4	5.6	July 24	8.8	10	7.8	Aug 24	8.7	9.1	8.4				
June 25	7.0	7.6	6.2	July 25	9.1	10.8	7.6	Aug 25	8.9	9.5	8.3				
June 26	6.8	7.6	5.8	July 26	9.6	11	8.3	Aug 26	8.5	9.5	7.6				
June 27	6.6	7	6.1	July 27	9.5	10.3	8.8	Aug 27	8.2	8.5	7.8				
June 28	6.5	7.1	6	July 28	9.0	9.3	8.9	Aug 28	7.8	8.7	7.1				
June 29	6.7	7.4	6.1	July 29	8.5	8.7	8.2	Aug 29	7.4	8.6	6.3				
June 30	7.1	7.9	6.4	July 30	8.3	9.2	7.4	Aug 30	7.6	8.6	6.4				
				July 31	8.7	9.8	7.6	Aug 31	8.6	9.5	7.8				

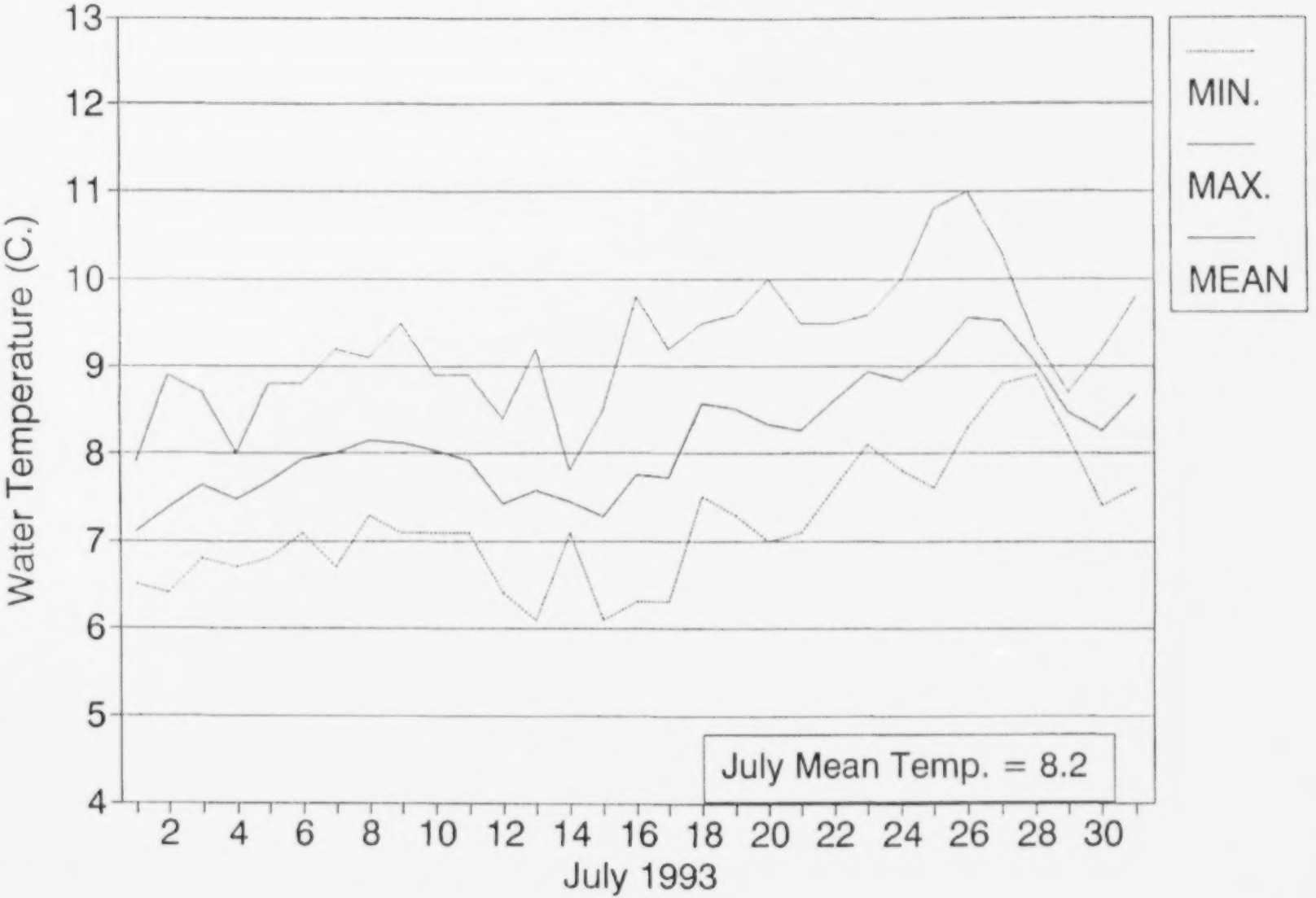
Culvert Water Temperatures 1993



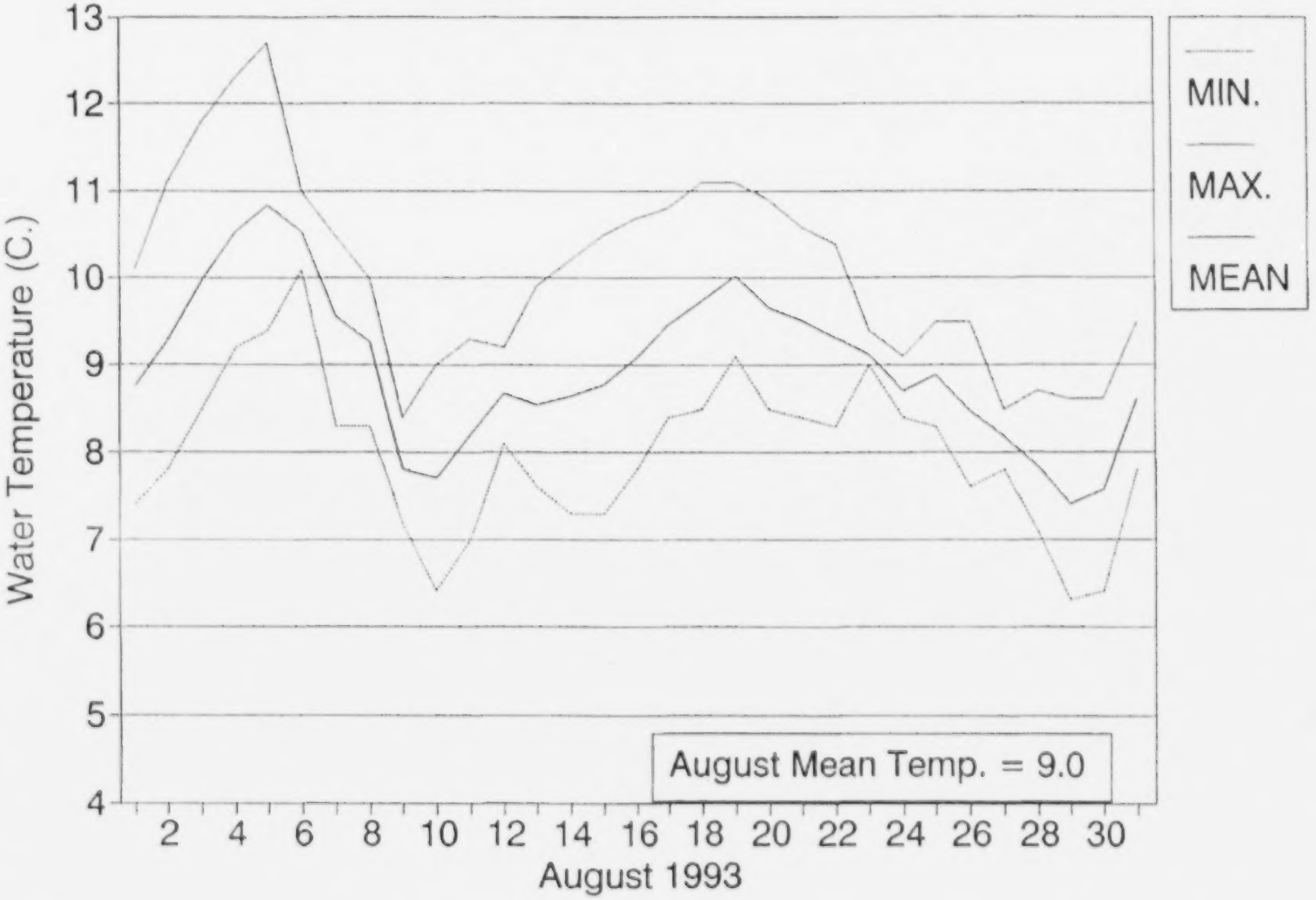
Culvert Water Temperatures 1993



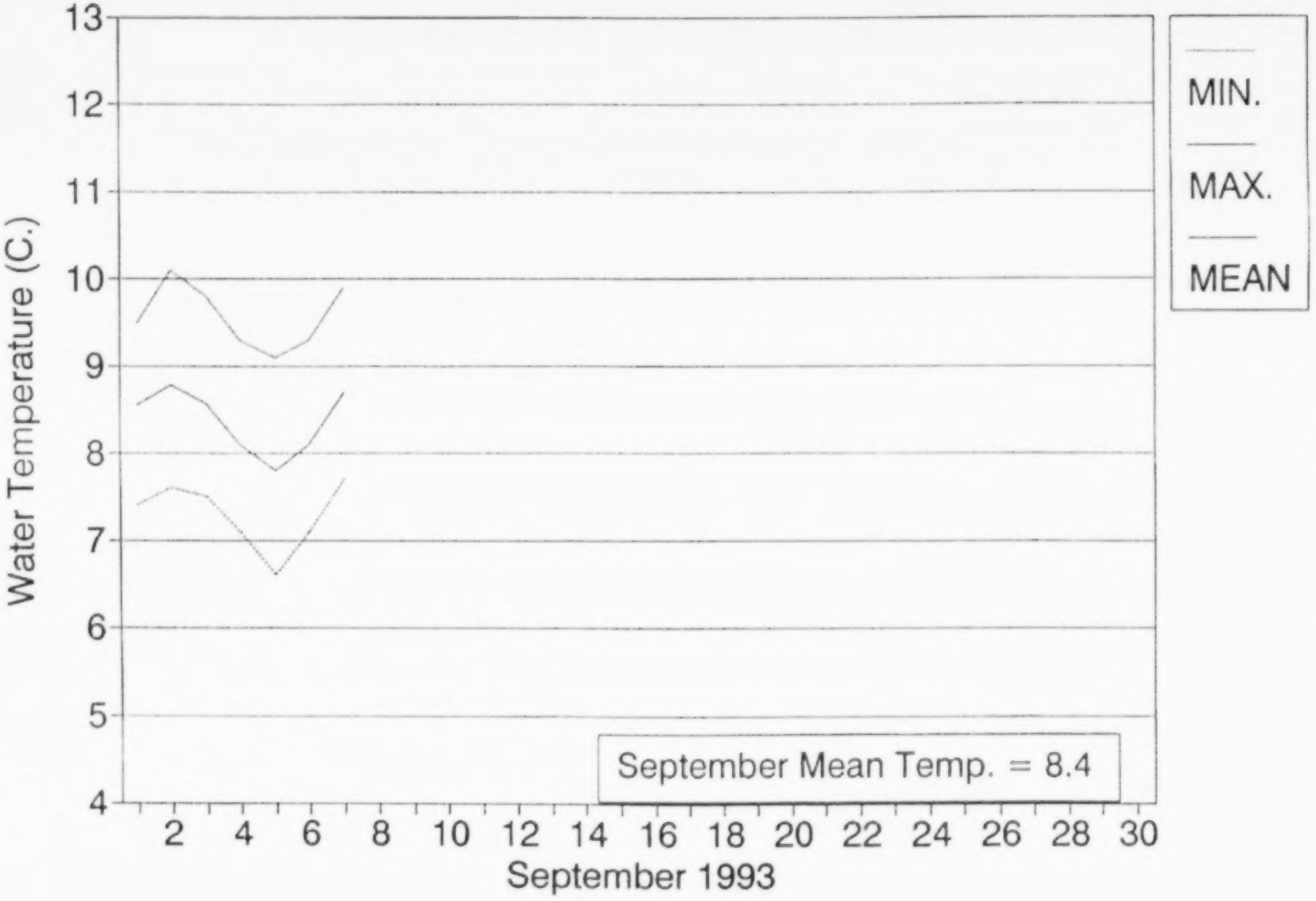
Culvert Water Temperatures 1993



Culvert Water Temperatures 1993



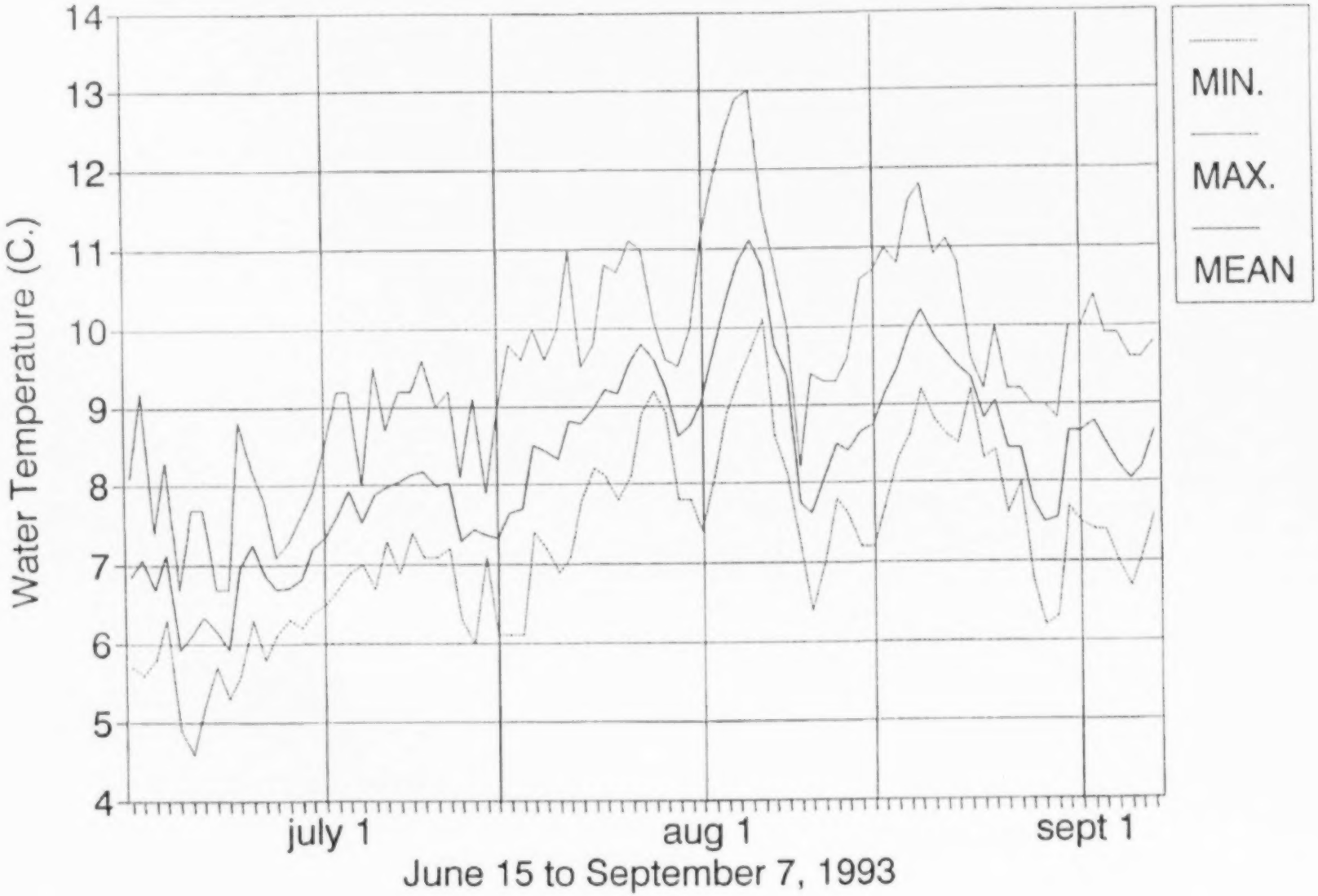
Culvert Water Temperatures 1993



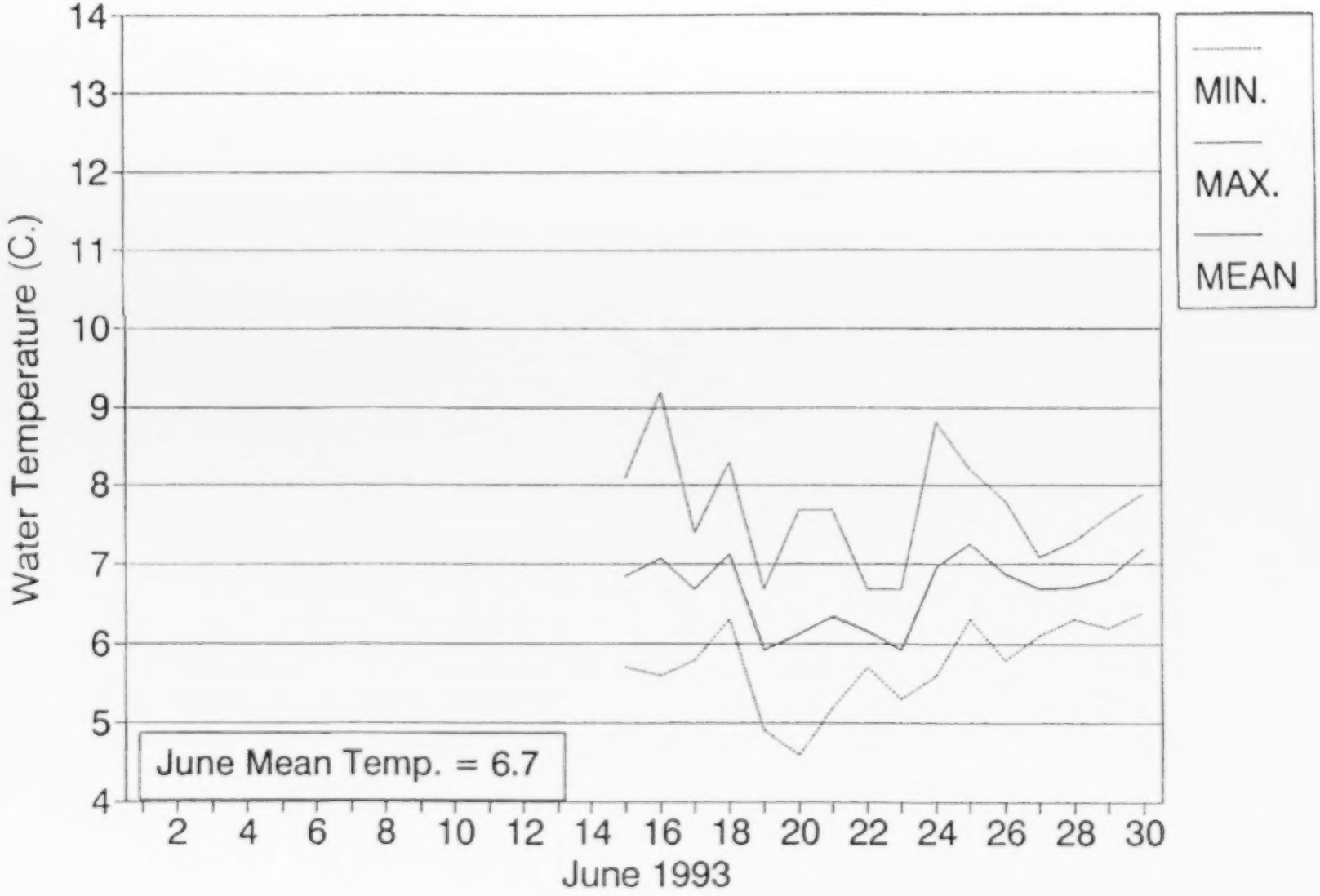
GOPHERHOLE CREEK WATER TEMPERATURES 1993

DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.
				July 1	7.4	8.5	6.5	Aug1	9.1	11.1	7.4	Sept 1	8.6	10	7.5
				July 2	7.6	9.2	6.7	Aug 2	9.7	11.9	8.1	Sept 2	8.8	10.4	7.4
				July 3	7.9	9.2	6.9	Aug 3	10.4	12.5	8.9	Sept 3	8.5	9.9	7.4
				July 4	7.5	8	7	Aug 4	10.8	12.9	9.3	Sept 4	8.3	9.9	7
				July 5	7.9	9.5	6.7	Aug 5	11.1	13	9.7	Sept 5	8.0	9.6	6.7
				July 6	8.0	8.7	7.3	Aug 6	10.7	11.5	10.1	Sept 6	8.2	9.6	7.1
				July 7	8.1	9.2	6.9	Aug 7	9.8	10.8	8.6	Sept 7	8.6	9.8	7.6
				July 8	8.1	9.2	7.4	Aug8	9.4	10	8.1				
				July 9	8.2	9.6	7.1	Aug 9	7.7	8.2	7.2				
				July 10	8.0	9	7.1	Aug10	7.6	9.4	6.4				
				July 11	8.0	9.2	7.2	Aug 11	8.1	9.3	7				
				July 12	7.3	8.1	6.3	Aug 12	8.5	9.3	7.8				
				July 13	7.4	9.1	6	Aug 13	8.4	9.6	7.6				
				July 14	7.4	7.9	7.1	Aug 14	8.6	10.6	7.2				
June 15	6.9	8.1	5.7	July 15	7.3	8.9	6.1	Aug 15	8.7	10.7	7.2				
June 16	7.1	9.2	5.6	July 16	7.6	9.8	6.1	Aug 16	9.1	11	7.7				
June 17	6.7	7.4	5.8	July 17	7.7	9.6	6.1	Aug 17	9.5	10.8	8.3				
June 18	7.1	8.3	6.3	July 18	8.5	10	7.4	Aug 18	9.9	11.6	8.6				
June 19	5.9	6.7	4.9	July 19	8.4	9.6	7.2	Aug 19	10.2	11.8	9.2				
June 20	6.1	7.7	4.6	July 20	8.3	10	6.9	Aug 20	9.9	10.9	8.8				
June 21	6.4	7.7	5.2	July 21	8.8	11	7.1	Aug 21	9.7	11.1	8.6				
June 22	6.2	6.7	5.7	July 22	8.8	9.5	7.8	Aug 22	9.5	10.8	8.5				
June 23	5.9	6.7	5.3	July 23	9.0	9.8	8.2	Aug 23	9.3	9.6	9.2				
June 24	7.0	8.8	5.6	July 24	9.2	10.8	8.1	Aug 24	8.8	9.2	8.3				
June 25	7.3	8.2	6.3	July 25	9.2	10.7	7.8	Aug 25	9.0	10	8.4				
June 26	6.9	7.8	5.8	July 26	9.6	11.1	8.1	Aug 26	8.4	9.2	7.6				
June 27	6.7	7.1	6.1	July 27	9.8	11	8.9	Aug 27	8.4	9.2	8				
June 28	6.7	7.3	6.3	July 28	9.6	10.1	9.2	Aug 28	7.8	9	6.8				
June 29	6.8	7.6	6.2	July 29	9.2	9.6	8.9	Aug 29	7.5	9	6.2				
June 30	7.2	7.9	6.4	July 30	8.6	9.5	7.8	Aug 30	7.5	8.8	6.3				
				July 31	8.8	10	7.8	Aug 31	8.6	10	7.7				

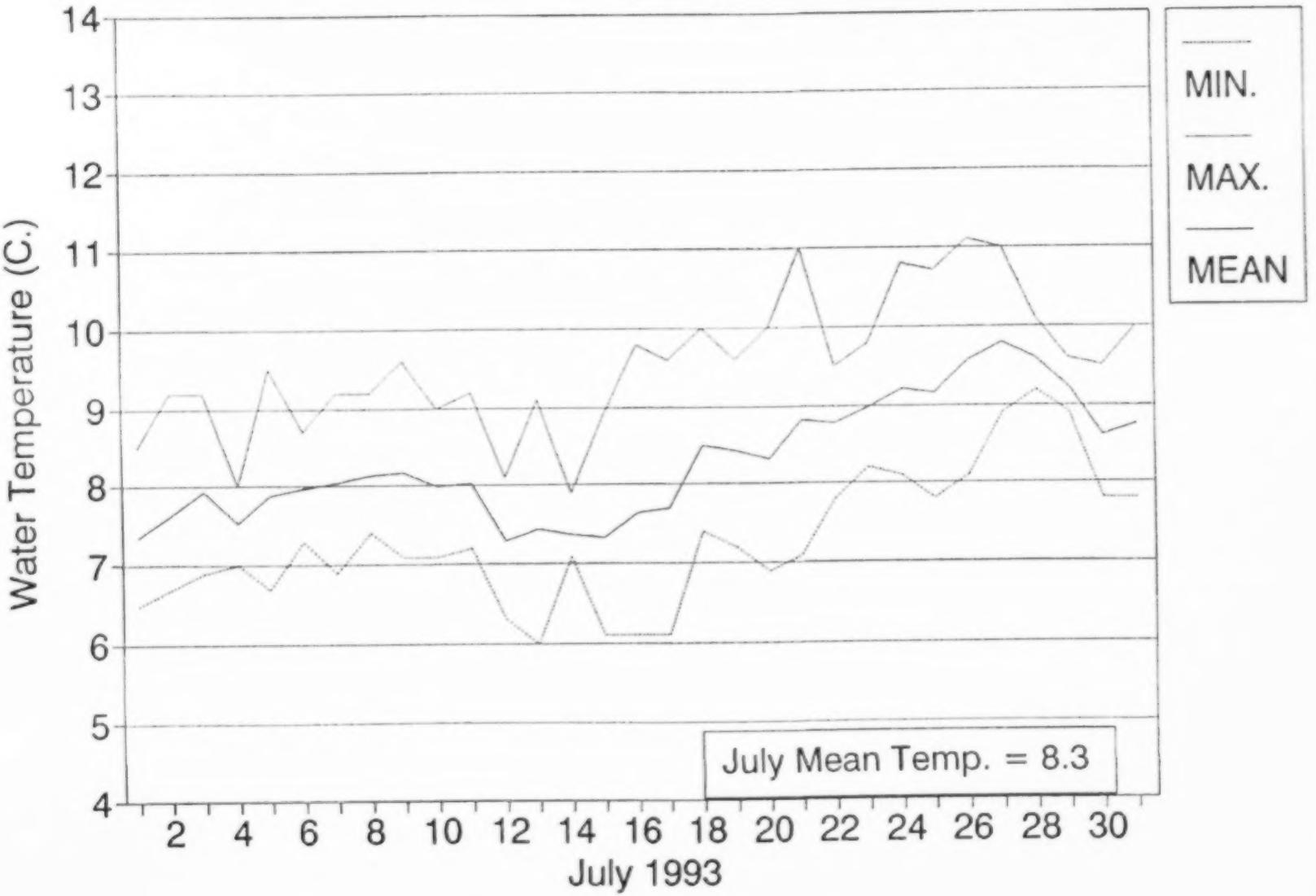
Gopherhole Water Temperatures 1993



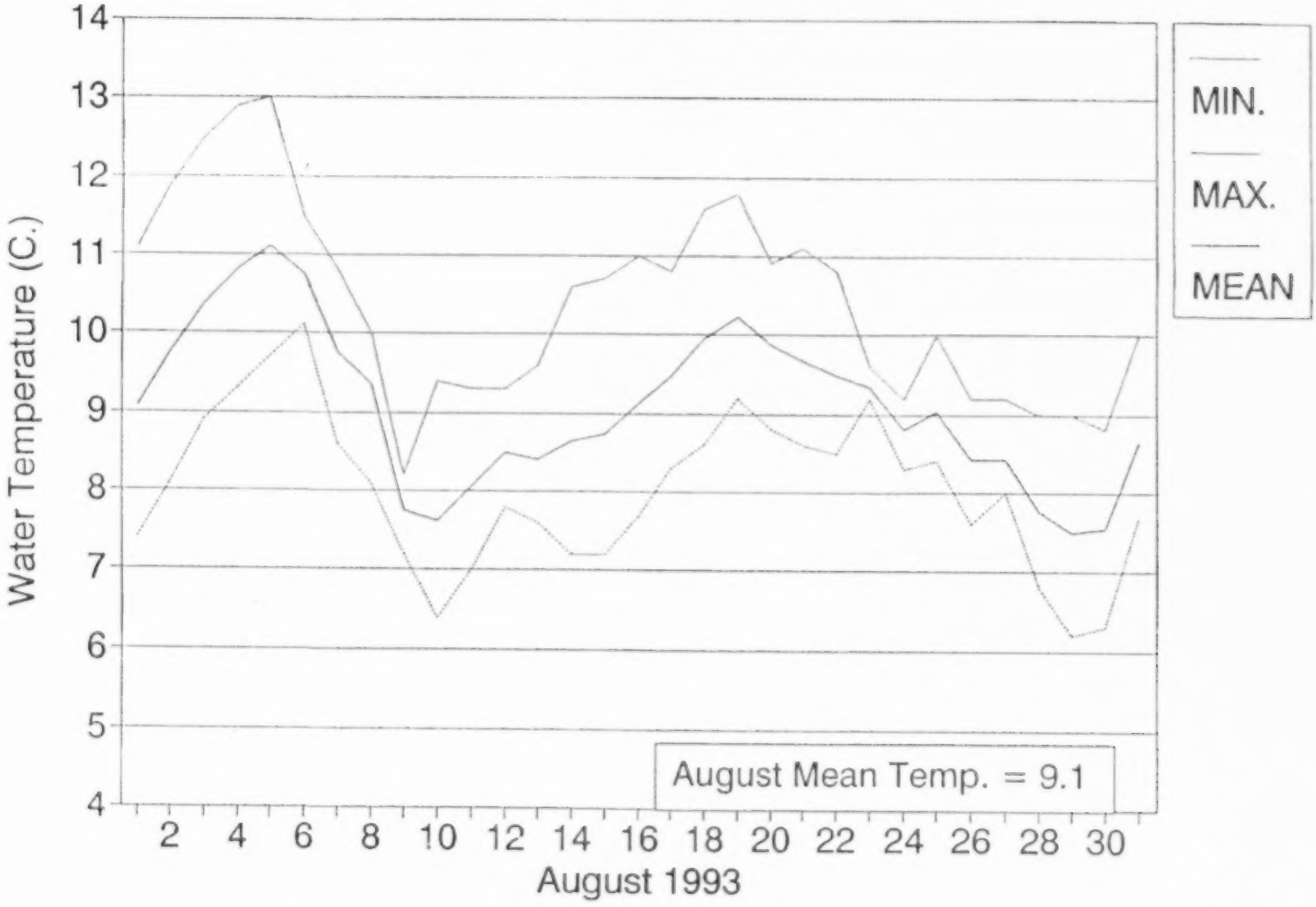
Gopherhole Water Temperatures 1993



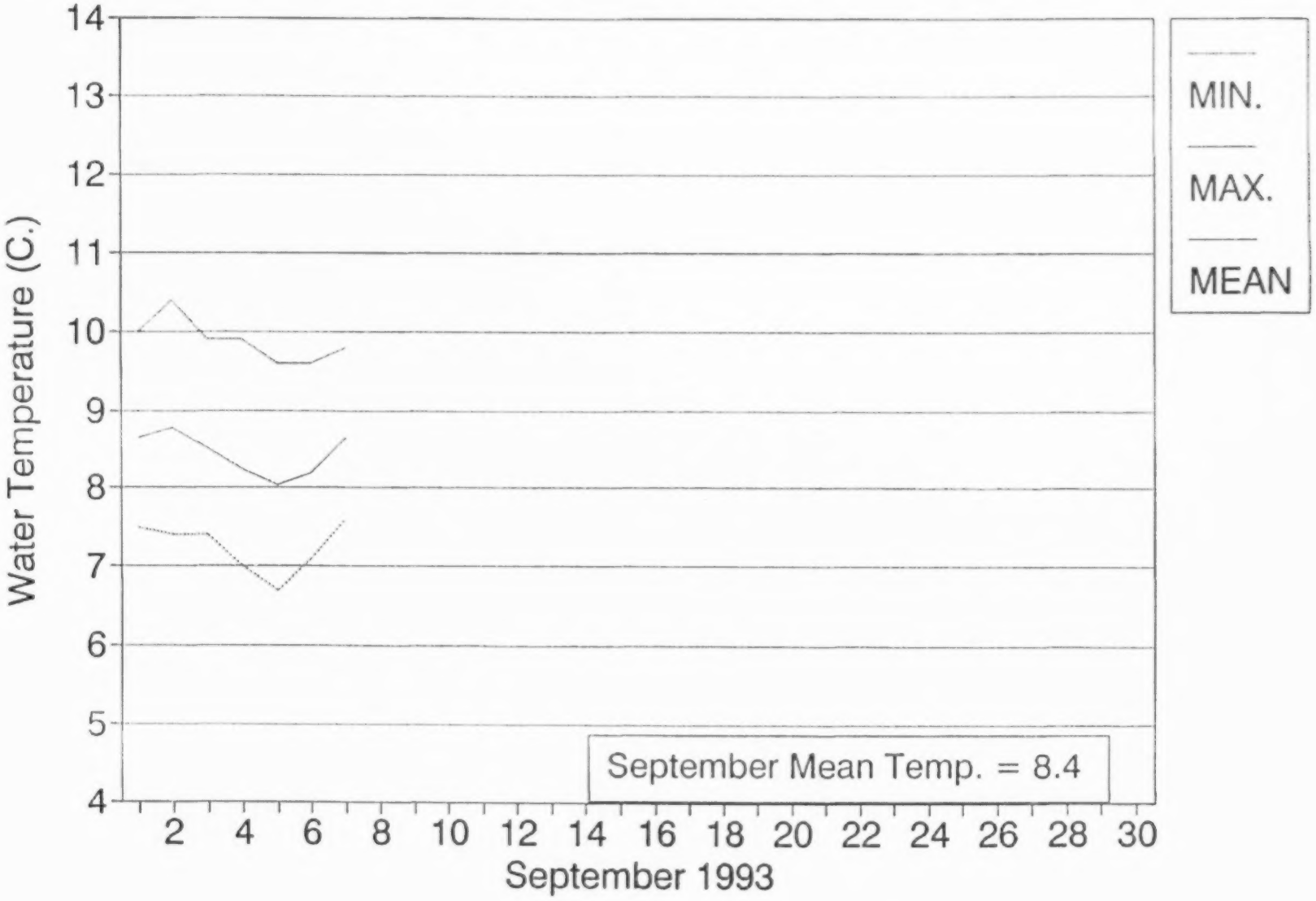
Gopherhole Water Temperatures 1993



Gopherhole Water Temperatures 1993



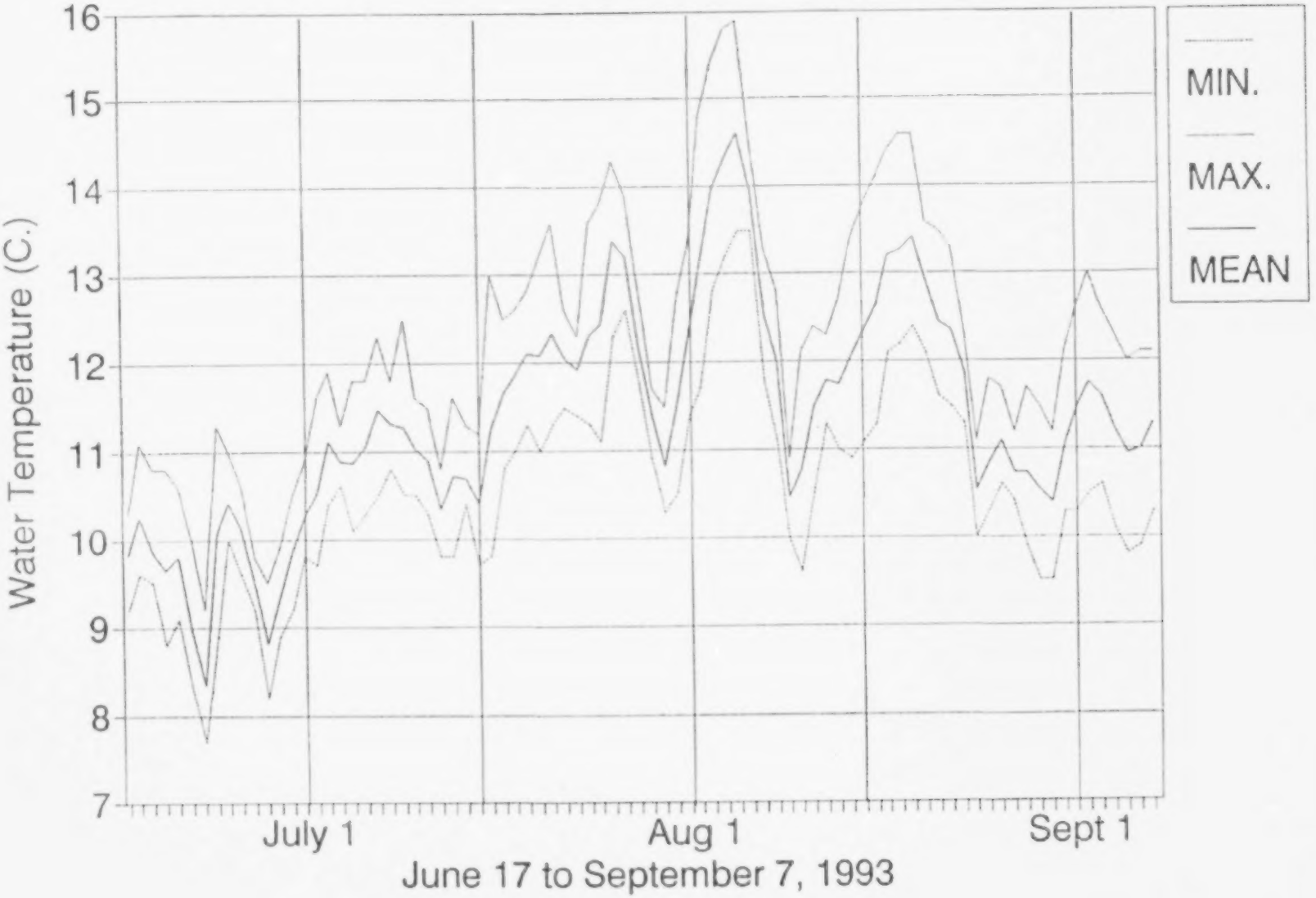
Gopherhole Water Temperatures 1993



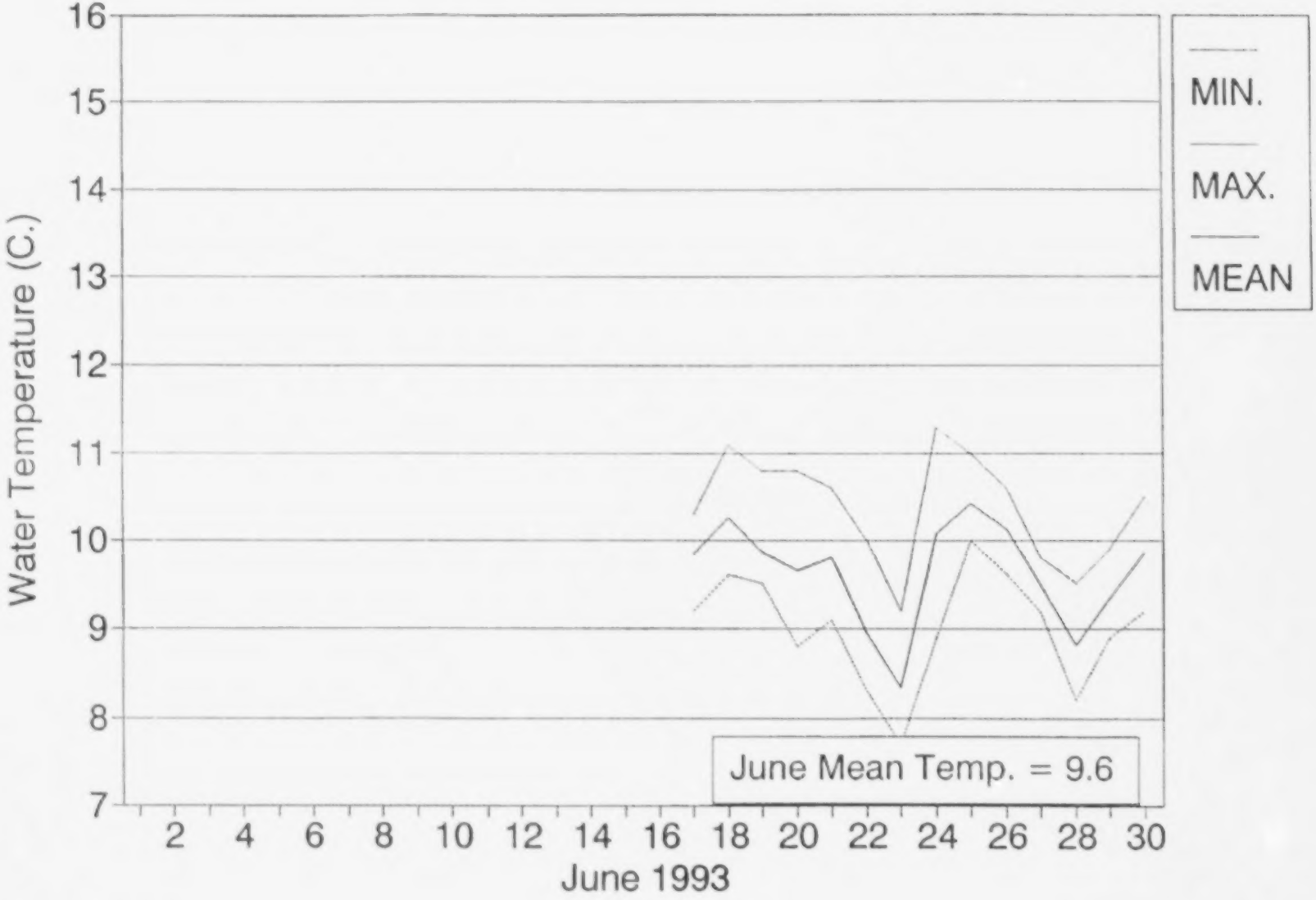
"GRATTON'S" WATER TEMPERATURES 1993

DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.
				July 1	10.3	10.9	9.8	Aug1	12.4	13.4	11.4	Sept 1	11.5	12.6	10.3
				July 2	10.5	11.6	9.7	Aug 2	13.1	14.8	11.7	Sept 2	11.8	13	10.5
				July 3	11.1	11.9	10.4	Aug 3	14.0	15.4	12.8	Sept 3	11.6	12.6	10.6
				July 4	10.9	11.3	10.6	Aug 4	14.3	15.8	13.2	Sept 4	11.2	12.3	10.1
				July 5	10.9	11.8	10.1	Aug 5	14.6	15.9	13.5	Sept 5	10.9	12	9.8
				July 6	11.1	11.8	10.3	Aug6	13.9	14.5	13.5	Sept 6	11.0	12.1	9.9
				July 7	11.5	12.3	10.5	Aug 7	12.5	13.3	11.8	Sept 7	11.3	12.1	10.3
				July 8	11.3	11.8	10.8	Aug8	12.0	12.8	11.1				
				July 9	11.3	12.5	10.5	Aug 9	10.5	10.9	10				
				July 10	11.0	11.6	10.5	Aug10	10.8	12.1	9.6				
				July 11	10.9	11.5	10.3	Aug 11	11.5	12.4	10.5				
				July 12	10.3	10.8	9.8	Aug 12	11.8	12.3	11.3				
				July 13	10.7	11.6	9.8	Aug 13	11.7	12.7	11				
				July 14	10.7	11.3	10.4	Aug 14	12.1	13.4	10.9				
				July 15	10.4	11.2	9.7	Aug 15	12.4	13.8	11.1				
				July 16	11.3	13	9.8	Aug 16	12.7	14.1	11.3				
June 17	9.8	10.3	9.2	July 17	11.7	12.5	10.8	Aug 17	13.2	14.4	12.1				
June 18	10.3	11.1	9.6	July 18	11.9	12.6	11	Aug 18	13.3	14.6	12.2				
June 19	9.9	10.8	9.5	July 19	12.1	12.8	11.3	Aug 19	13.4	14.6	12.4				
June 20	9.7	10.8	8.8	July 20	12.1	13.2	11	Aug 20	12.9	13.6	12.1				
June 21	9.8	10.6	9.1	July 21	12.3	13.6	11.3	Aug 21	12.5	13.5	11.6				
June 22	8.9	10	8.3	July 22	12.1	12.6	11.5	Aug 22	12.3	13.3	11.5				
June 23	8.3	9.2	7.7	July 23	11.9	12.3	11.4	Aug 23	11.9	12.3	11.3				
June 24	10.1	11.3	8.9	July 24	12.3	13.6	11.3	Aug 24	10.5	11.1	10				
June 25	10.4	11	10	July 25	12.4	13.8	11.1	Aug 25	10.9	11.8	10.3				
June 26	10.1	10.6	9.6	July 26	13.4	14.3	12.3	Aug 26	11.1	11.7	10.6				
June 27	9.5	9.8	9.2	July 27	13.2	13.9	12.6	Aug 27	10.7	11.2	10.4				
June 28	8.8	9.5	8.2	July 28	12.2	12.8	11.8	Aug 28	10.7	11.7	9.9				
June 29	9.3	9.9	8.9	July 29	11.4	11.7	10.9	Aug 29	10.5	11.5	9.5				
June 30	9.9	10.5	9.2	July 30	10.8	11.5	10.3	Aug 30	10.4	11.2	9.5				
				July 31	11.5	12.7	10.5	Aug 31	11.1	12.1	10.3				

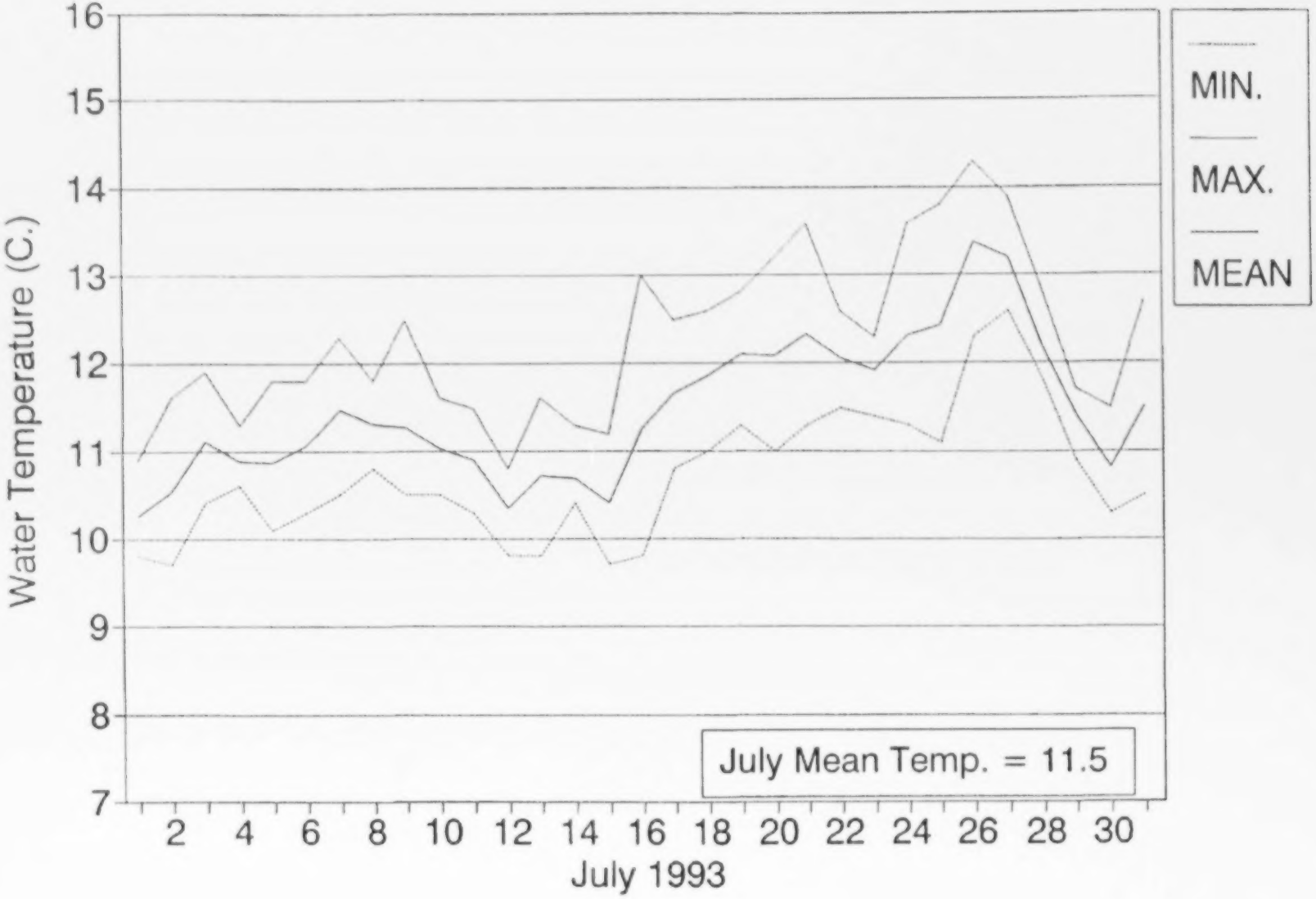
"Gratton's" Water Temperatures 1993



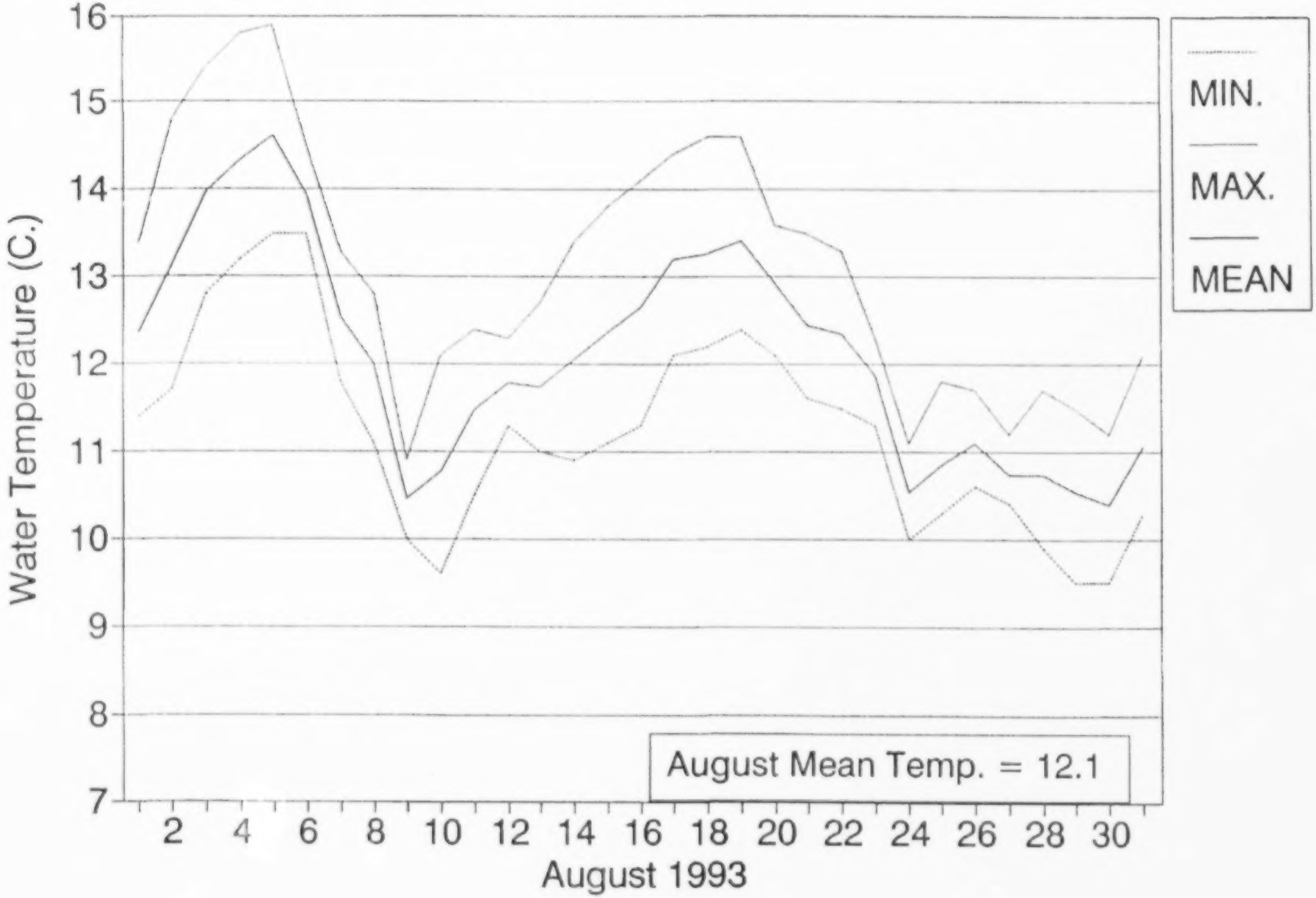
"Gratton's" Water Temperatures 1993



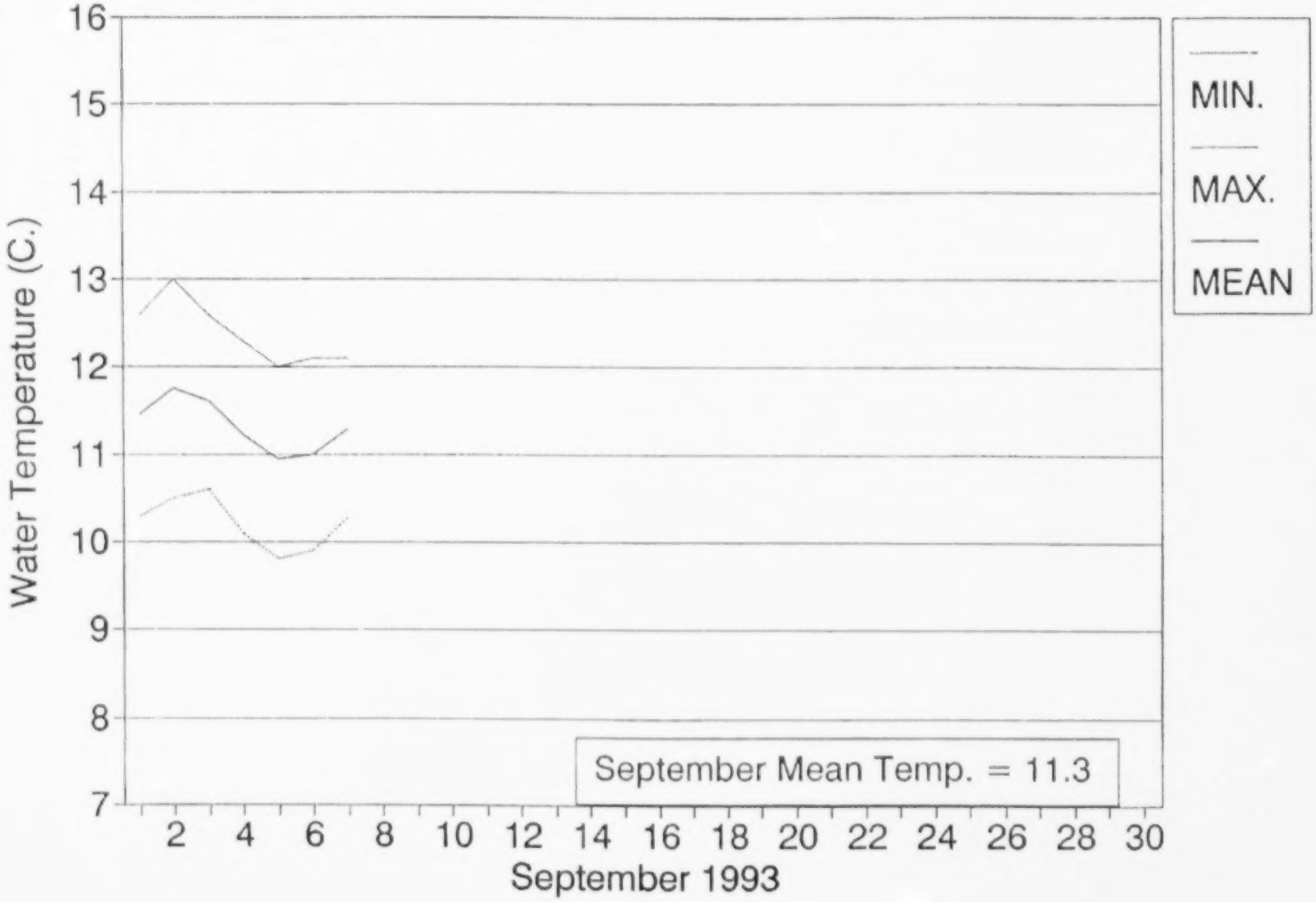
"Gratton's" Water Temperatures 1993



"Gratton's" Water Temperatures 1993



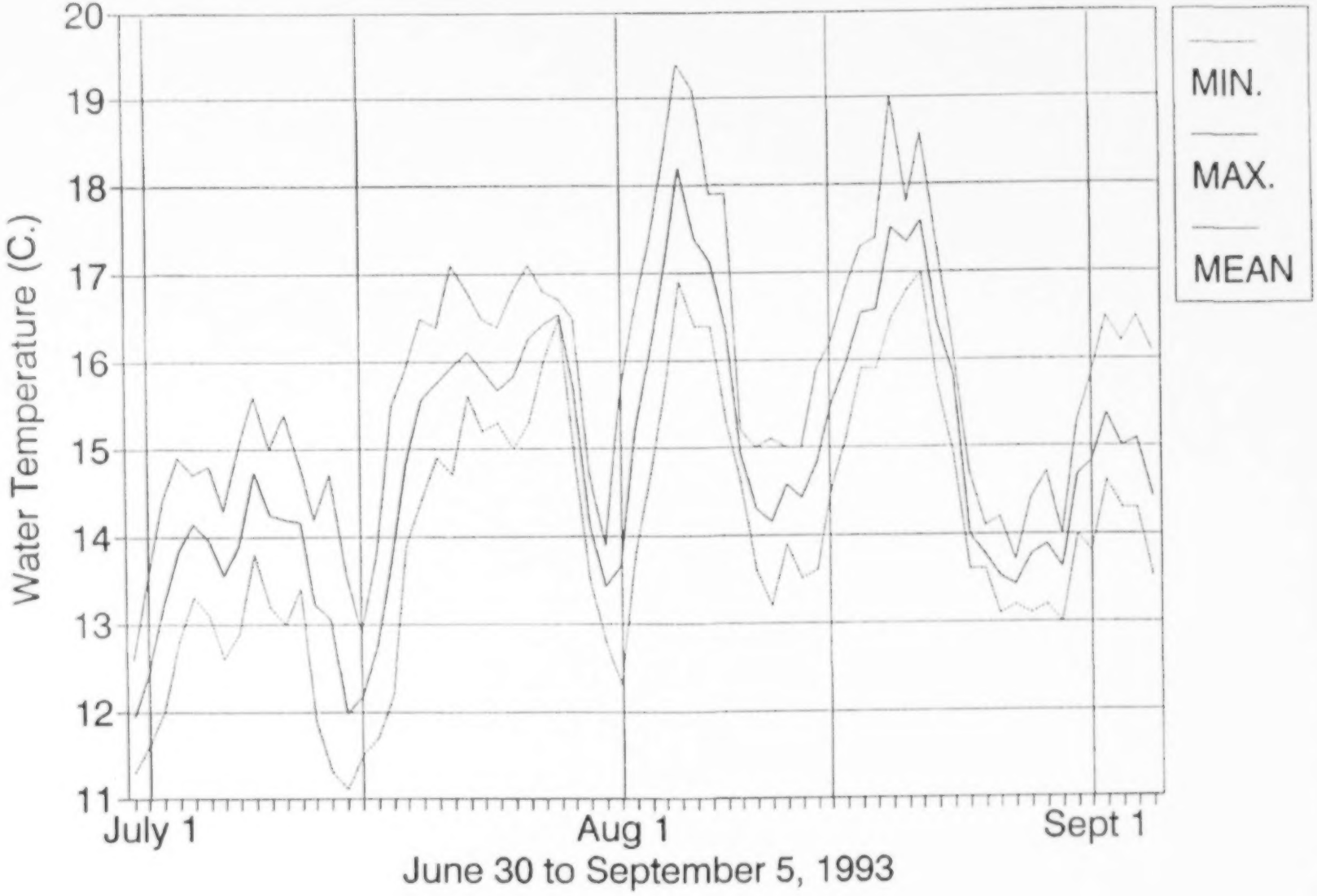
"Gratton's" Water Temperatures 1993



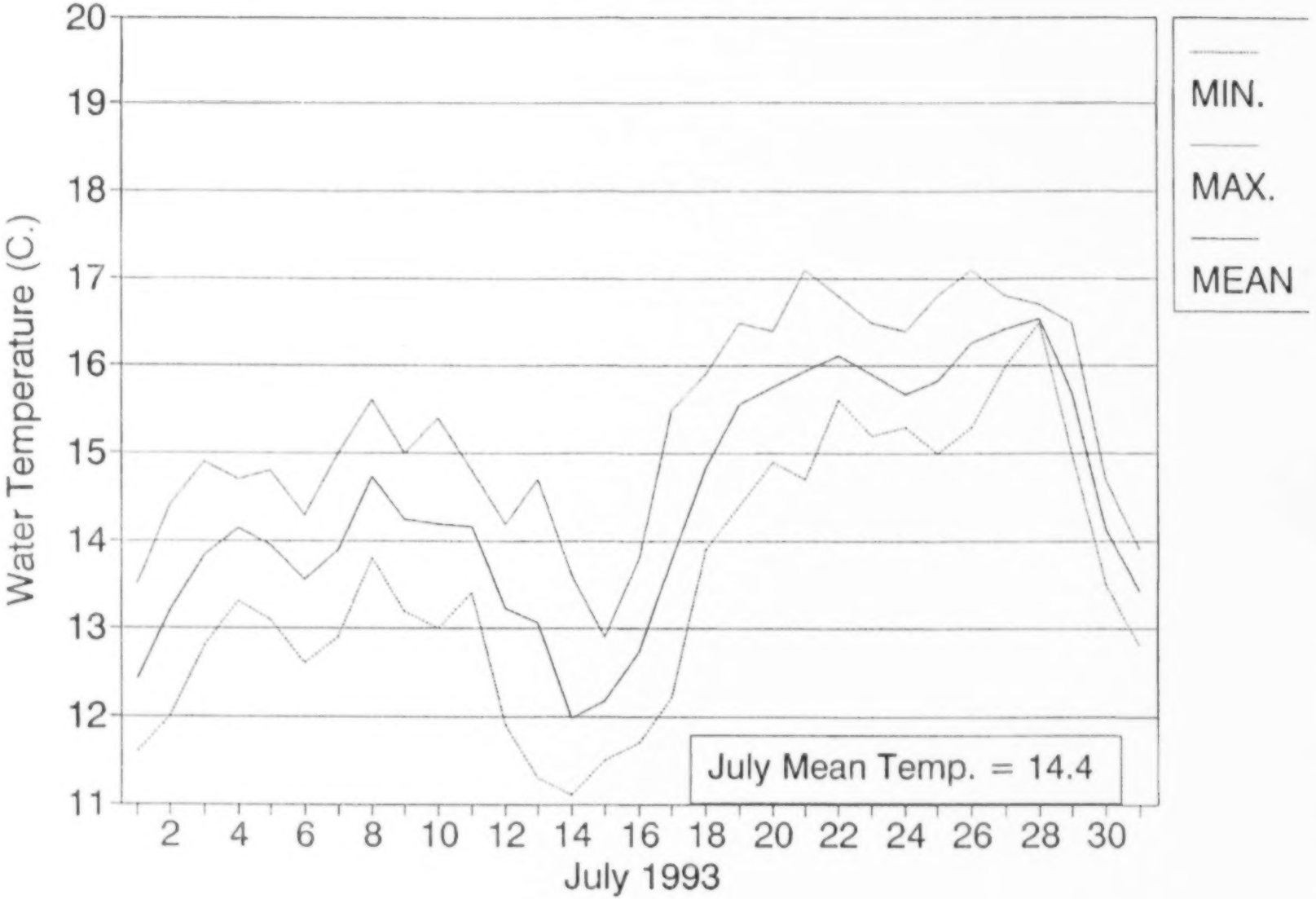
NATION RIVER WATER TEMPERATURES 1993

DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.	DATE	MEAN	MAX.	MIN.
				July 1	12.4	13.5	11.6	Aug1	13.7	15.6	12.3	Sept 1	14.8	15.8	13.8
				July 2	13.2	14.4	12	Aug 2	15.2	16.6	13.8	Sept 2	15.4	16.5	14.6
				July 3	13.8	14.9	12.8	Aug3	16.1	17.4	14.7	Sept 3	15.0	16.2	14.3
				July 4	14.1	14.7	13.3	Aug 4	17.0	18.3	15.6	Sept 4	15.1	16.5	14.3
				July 5	13.9	14.8	13.1	Aug 5	18.2	19.4	16.9	Sept 5	14.4	16.1	13.5
				July 6	13.6	14.3	12.6	Aug 6	17.4	19.1	16.4				
				July 7	13.9	15	12.9	Aug 7	17.1	17.9	16.4				
				July 8	14.7	15.6	13.8	Aug8	16.4	17.9	15.3				
				July 9	14.2	15	13.2	Aug 9	14.9	15.2	14.6				
				July 10	14.2	15.4	13	Aug10	14.3	15	13.6				
				July 11	14.2	14.8	13.4	Aug 11	14.2	15.1	13.2				
				July 12	13.2	14.2	11.9	Aug 12	14.6	15	13.9				
				July 13	13.1	14.7	11.3	Aug13	14.4	15	13.5				
				July 14	12.0	13.6	11.1	Aug 14	14.8	15.9	13.6				
				July 15	12.2	12.9	11.5	Aug 15	15.5	16.2	14.5				
				July 16	12.7	13.8	11.7	Aug 16	16.0	16.8	15.1				
				July 17	13.8	15.5	12.2	Aug17	16.6	17.3	15.9				
				July 18	14.8	15.9	13.9	Aug 18	16.6	17.4	15.9				
				July 19	15.6	16.5	14.4	Aug 19	17.5	19	16.5				
				July 20	15.8	16.4	14.9	Aug 20	17.4	17.8	16.8				
				July 21	15.9	17.1	14.7	Aug 21	17.6	18.6	17				
				July 22	16.1	16.8	15.6	Aug 22	16.4	17.3	15.7				
				July 23	15.9	16.5	15.2	Aug 23	15.8	16.1	14.9				
				July 24	15.7	16.4	15.3	Aug 24	14.0	14.7	13.6				
				July 25	15.8	16.8	15	Aug 25	13.8	14.1	13.6				
				July 26	16.3	17.1	15.3	Aug 26	13.5	14.2	13.1				
				July 27	16.4	16.8	16	Aug 27	13.4	13.7	13.2				
				July 28	16.5	16.7	16.5	Aug 28	13.8	14.4	13.1				
				July 29	15.7	16.5	15	Aug 29	13.9	14.7	13.2				
June 30	11.9	12.6	11.3	July 30	14.1	14.7	13.5	Aug 30	13.6	14	13				
				July 31	13.4	13.9	12.8	Aug 31	14.7	15.3	14				

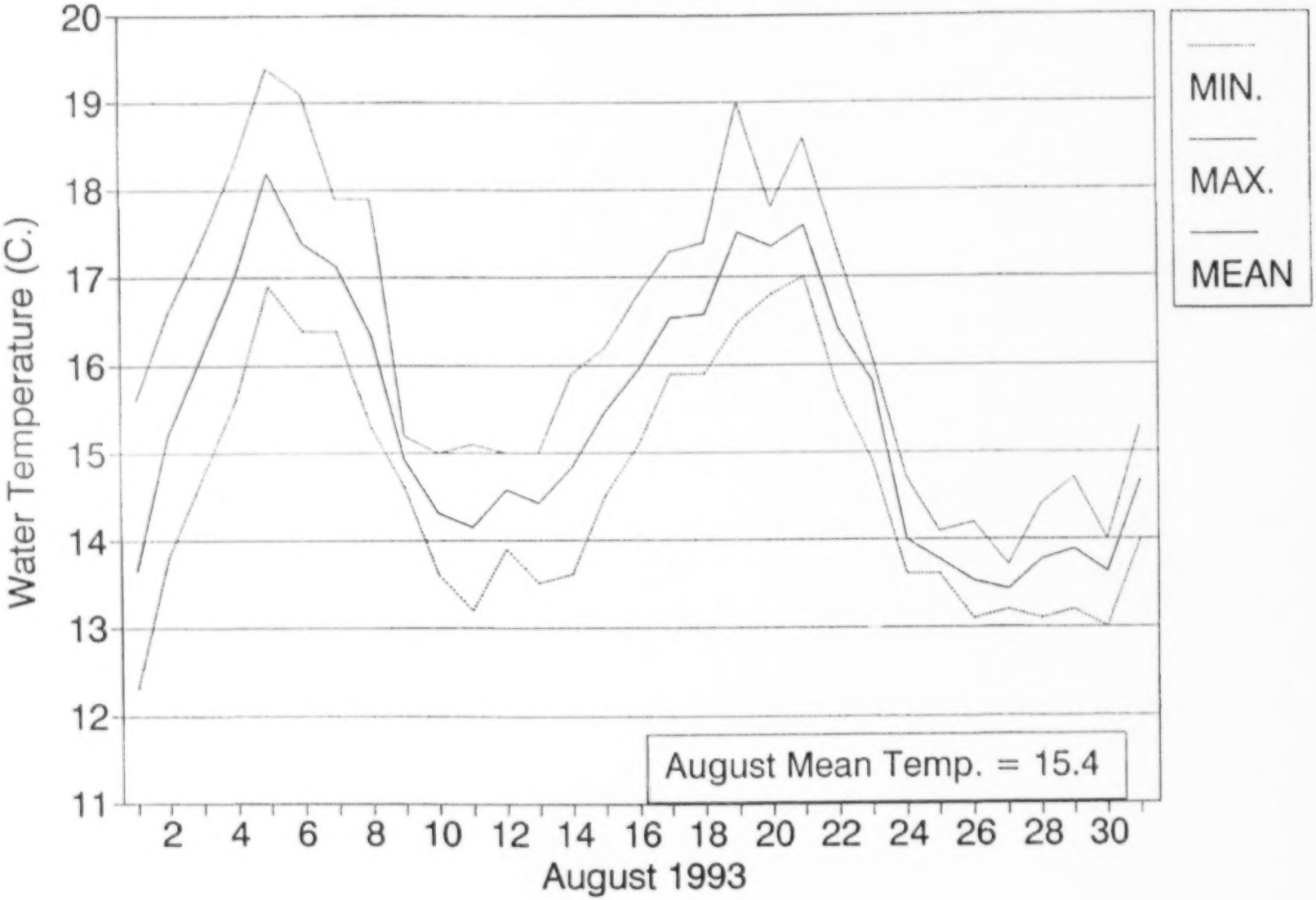
Nation Water Temperatures 1993



Nation Water Temperatures 1993



Nation Water Temperatures 1993



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